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USAARL REPORT NO. 69-2

SELECTED ANTHROPOMETRIC MEASUREMENTS OF 1640  
U. S. ARMY WARRANT OFFICER CANDIDATE FLIGHT TRAINEES

By

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February 1969

U. S. ARMY AEROMEDICAL RESEARCH LABORATORY  
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Comparison of these data was performed against similar measurements conducted upon flying personnel in five separate studies by other military services.

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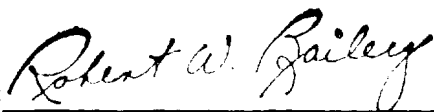
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## ABSTRACT

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Comparison of these data was performed against similar measurements conducted upon flying personnel in five separate studies by other military services.

APPROVED:   
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LTC, MSC  
Commanding

# SELECTED ANTHROPOMETRIC MEASUREMENTS OF 1640 U. S. ARMY WARRANT OFFICER CANDIDATE FLIGHT TRAINEES

## INTRODUCTION

Only recently has the U. S. Army been involved in procurement of aircraft designed specifically for Army use. In the design of these aircraft, specific anthropometric information is necessary to provide sufficient work space for safe, comfortable operation of the aircraft. In 1961 a sample of 500 Army aviators was measured which incorporated 141 warrant officer aviators and 359 commissioned officer aviators.<sup>6</sup> It appeared, however, from discussion with aircraft designers that data from this study was not being used to design U. S. Army aircraft. Also, demands upon Army aviation in the Republic of Vietnam have created a population of aviators variant from that sampled in 1961. According to the U. S. Army Personnel Directorate, in October 1968 the Army had 9,214 warrant officer aviators and 9,507 commissioned officer aviators. It is anticipated by this same agency that by FY 1970 the Army will have 11,850 warrant officer aviators and 14,197 commissioned officer aviators.

We felt strongly that a large current U. S. Army aviation population should be surveyed since we suspected that our aviator population would not correlate with aviator populations studied by the U. S. Air Force and U. S. Navy. For example, we suspect that the total U. S. Army aviator population will not be normally distributed because it is derived from two sources:

1. Officers, all of whom are college graduates.
2. Enlisted personnel, who are commissioned as warrant officers upon completion of flight training, few of whom are college graduates.

We might anticipate, therefore, a bimodal distribution of our measurements.

When it did not appear that a major study would be performed by other Army agencies we took it upon ourselves to begin a modest measuring program at Fort Rucker in the hope that we could generate some of the anthropometric information necessary for medical evaluation of the cockpit and of restraint and egress systems. It was also hoped that this initial study would serve to stimulate interest in, and reaffirm a need for, a larger and more thorough study of the U. S. Army aviator population.

This paper represents the results of measurement of 1,640 warrant officer candidates between the period January 1967 to August 1968. It is presented primarily to display our techniques and results for review and criticism in the hope that when a major measuring program can be performed, we will have developed the knowledge, skill and computer software necessary to produce meaningful and useful information.

## METHOD

The subjects measured constituted all available warrant officer candidates scheduled to graduate from flight training at Fort Rucker, Alabama between January 1967 and August 1968. Because of scheduling difficulties, several classes were missed, and some individuals could not make their appointment for measurement because of other commitments of higher priority. These omissions are felt to be random, and not biasing.

We elected to perform only these nine measurements:

1. Weight
2. Stature
3. Functional reach
4. Sitting height
5. Eye height, sitting
6. Bideloid diameter
7. Buttock-knee length
8. Hip breadth, sitting
9. Buttock-leg length

These measurements were taken using standard Siber Hegner metric anthropometers. Weights were determined on a Model 41-3314 Fairbanks-Morse balance, Serial No. G623829. This metric balance weighs to  $\pm 10$  grams. The methods of measurement and posing of the subjects we used were those described by Hertzberg, et al.<sup>2</sup>

Two measurers were used throughout the study, and one individual performed all our weighing. Measurements were recorded on a standard form, from which they were transcribed onto punch cards for analysis on an IBM 1130 computer.



## COMPUTER ANALYSIS

As soon as the measurements were recorded on punch cards, the cards were submitted to inspection by the computer. Multiple regression line formulae were developed which permitted prediction of any 9th value given the other eight values. The computer reviewed each measurement on each card, and rejected any card with a measurement which varied from the predicted value by 5 standard errors or more. These cards were immediately reviewed for transcribing errors, and corrections were made whenever possible. When clerical errors could not be found, the subject was recalled for repeat measurements. When these repeat measurements were performed, the measurer performed all nine measurements and was not told the values of the previous measurements nor the specific measurement in question. The new measurements were then incorporated into the study, and the measurements containing the questioned value were discarded. When it was not possible to remeasure, and the measured and predicted values differed by greater than 10 standard errors, the card was deleted. Using this method of inspection, of the 1,644 subjects measured, 218 cards were reviewed, and only 4 cards required rejection. We found this subroutine so valuable in identification of transcribing errors which could be immediately corrected that it is included as Annex 1 of this paper.

## RESULTS

Results of measurement are shown in Annexes II through V.

Annex II	Mean, range, standard deviation, percentile ranking.
Annex III	Selected variant scatter diagrams.
Annex IV	Histograms.
Annex V	10 x 10 correlation matrix.
Annex VI	Comparative graphs.

During the course of the study, we came to agree with the published opinion of Hertzberg, et al<sup>2</sup> that "buttock-leg length" is a difficult measurement to perform correctly. We also have reservations about the reproducibility of our "functional reach". We report these results with the comment that our dispersions are no greater than others reported in the open literature for these measurements, but nonetheless, we defer to the opinion of the reader the validity of our statistics upon these measurements.

## DISCUSSION

Discussion with aircraft cockpit designers indicated that interior cockpit design and aircrew work space could be effectively configured with a limited number of selected anthropometric measurements. Because flight safety as it is reflected in cockpit design was our primary interest, and because only a limited time was available to us, for both training and to actually perform measurements, we elected to perform only the nine measurements listed. It was anticipated that these measurements would:

1. Provide us with preliminary information about aircrew work space requirements in Army aircraft.
2. Allow us to make comparisons between our sample and other samples.
3. Permit us to develop some experience in the techniques of measurement and data handling.

We knew before we began measurement that the results obtained would not be applicable to a general population of Army aviators. These reasons are most obvious:

1. Our sample contained only warrant officer candidates, and therefore, represents only about half of the total Army aviator population. Indeed, they do not even truly represent warrant officer aviators, since
2. The mean age of our sample indicates that our sample has not achieved full growth.

Nonetheless, the measurement and data processing was a valuable learning experience, and in addition, gave us the first thorough look at a new population of Army aviators.

Considering the highly selective nature of our own sample, and the heterogeneity among the samples with which we can compare it, statistical comparisons have questionable validity. Table I clearly indicates the magnitude of statistical differences between results of comparable measurements in the most current anthropometric surveys of the three services.

Table II shows means and standard deviations from which these  $t$ 's were calculated, and summarizes the mean, standard deviation, and coefficient of variation of nine measurements determined in this study, and comparable measurements from five other anthropometric surveys conducted upon flight personnel by other military agencies.

Table III shows range, grand mean,\* and pooled standard deviation ‡ for these six studies. This pooled information admittedly not applicable for statistical inference, shows that in spite of the statistical differences between studies, the actual numerical differences are small for practical engineering use. In fact, the range in most instances is only about 1 inch, and rarely does the mean of any individual measurement in Table II vary more than 0.5 inches from its grand mean.

$$* \quad \bar{x}_G = \frac{\sum_{i=1}^k \bar{x}_i n_i}{\sum_{i=1}^k n_i} = \text{Grand mean}$$

$$‡ \quad s_G = \frac{\sum_{i=1}^k n_i s_i^2}{\sum_{i=1}^k n_i} = \text{Pooled standard deviation}$$

What this suggests is that statistical significance and practical significance may not necessarily coincide in this instance. The very large numbers of subjects involved make even small numerical differences statistically significant. These same small differences might be of little practical importance to the design engineer developing crew work space in some future Army helicopter.

Until a complete U. S. Army anthropometric study can be performed, Table IV suggests one method of estimating the U. S. Army requirement in some specified measurement. In Table IV we have compared the results of our study with the grand means and pooled standard deviations of the three most current anthropometric surveys of flying personnel, one from each of the three military services. <sup>1,5,6</sup> It can be seen that our mean values are constantly lower than the grand mean but in only one instance greater than 0.34 inches. In all measurements, our mean fell somewhere between the grand mean and -1 standard deviation from that mean. (It is suggested that this consistent variation to the low side is caused by the fact that our population has not as yet achieved full growth.) In the case of all linear measurements, our standard deviations never varies from the pooled standard deviation by more than 0.08 inch. Because our sample means correlate better with the grand mean of these three studies than with the means of any individual study alone, it is proposed that if one wishes to estimate a dimension for the U. S. Army warrant officer candidate population, the grand mean and pooled standard deviation of these three designated studies be accepted as a reasonable approximation until a complete anthropometric survey of U. S. Army aviators can be completed.

#### SUMMARY

1. The results of nine anthropometric measurements conducted upon 1,640 U. S. Army warrant officer candidates are presented. The nine measurements were selected as those which contribute most to aircrew work space design in aircraft.
2. Comparison of these data was performed against similar measurements conducted upon flying personnel in five separate studies by other military services.
3. Until a definitive anthropometric survey can be conducted upon U. S. Army flying personnel, it is suggested that if a specific dimension for warrant officer candidates is required, a good estimate can be obtained by using the grand mean and pooled standard deviation of the desired dimension calculated from the three designated complete anthropometric surveys.

TABLE I

† TEST FOR COMPARISON BETWEEN THE INDICATED STUDIES

	USAF 1967 <sup>5</sup> vs USN 1965 <sup>1</sup>	USAF 1967 <sup>5</sup> vs USA 1961 <sup>6</sup>	USN 1965 <sup>1</sup> vs USA 1961 <sup>6</sup>
Age	1.498	- 0.807	4.191
Weight	3.289	7.578	5.745
Stature	1.538	2.729	3.726
Functional Reach	2.234	-	-
Sitting Height	10.080	17.559	10.406
Eye Height, Sitting	7.772	16.304	10.741
Bideltoid Diameter	6.638	14.872	11.040
Buttock-knee Length	- 9.187	- 0.727	5.181
Hip Breadth	13.510	15.611	6.886

† 0.05,  $\infty$  = 1.645† 0.025,  $\infty$  = 1.960† 0.01,  $\infty$  = 2.326† 0.005,  $\infty$  = 2.576

TABLE II

## TABULATION FOR COMPARISON OF SELECTED ANTHROPOMETRIC MEASUREMENTS

	USAARL 1969 n = 1640	USAF <sup>5</sup> 1967 n = 2420	USAF <sup>2</sup> 1954 n = 4057	USN <sup>1</sup> 1965 n = 1549	USA <sup>6</sup> 1961 n = 500	USAF <sup>4</sup> 1965 n = 2632
Age	22.0 2.9 13.18	30.03 6.31 21.00	27.82 4.19 15.02	29.16 <sup>2</sup> 5.32 18.24	30.27 4.58 15.13	19.3 1.3 6.73
Weight	164.0 18.7 11.40	173.60 21.44 12.35	163.66 20.86 12.74	171.40 19.09 11.14	165.772 18.899 11.400	151.4 22.5 14.86
Stature	69.7 2.4 3.44	69.82 2.44 3.49	69.11 2.44 3.53	69.94 2.33 3.33	69.497 2.251 3.239	68.92 2.55 3.69
Functional Reach	31.4 1.5 4.78	31.62 1.57 4.96	32.33 1.63 5.04	31.51 1.42 4.51	- - -	31.19 1.66 5.32
Sitting Height	36.2 1.3 3.59	36.69 1.25 3.41	35.94 1.29 3.58	36.28 1.25 3.43	35.608 1.271 3.569	35.87 1.37 3.81
Eye Height, Sitting	31.4 1.2 3.82	31.87 1.19 3.73	31.47 1.27 4.03	31.57 1.18 3.75	30.904 1.281 4.145	31.40 1.29 4.10
Bideltoid Diameter	18.5 0.9 4.86	18.99 1.01 5.31	17.88 0.91 5.06	18.78 0.91 4.83	18.268 0.875 4.790	18.02 0.98 5.43
Buttock-knee Length	23.8 1.1 4.62	23.78 1.06 4.47	23.62 1.06 4.50	24.09 1.00 4.15	23.818 1.082 4.543	23.73 1.15 4.84
Hip Breadth, Sitting	13.9 0.8 5.76	14.88 0.91 6.09	13.97 0.87 6.23	14.49 0.85 5.90	14.187 0.872 6.146	13.88 0.99 7.13

- Indicates that this measurement was not performed.

Numerals are recorded to the significance attributed by the original authors.

TABLE III

COMPARISON OF USAARL 1969 WITH GRAND MEAN AND POOLED  
STANDARD DEVIATION OF SIX ANTHROPOMETRIC SURVEYS

n = 6

	Range	$\bar{x}_G$ $s_G$	USAARL 1969 n = 1640	$x - \bar{x}_G$	z
Age	19.3 - 30.27 (10.97 yr)	26.00 4.33	22.0 2.9	-4.00	-0.9237
Weight	151.4 - 173.60 (22.20 lb)	164.08 20.78	164.0 18.7	-0.08	-0.0038
Stature	68.92- 69.94 ( 1.02 in)	69.40 2.44	69.7 2.4	0.30	0.1229
Functional Reach *	31.19 - 32.33 ( 1.14 in)	31.72 1.58	31.4 1.5	-0.32	-0.2025
Sitting Height	35.608- 36.69 ( 1.082 in)	36.13 1.30	36.2 1.3	0.07	0.0538
Eye Height, Sitting	30.904- 31.87 ( 0.966 in)	31.51 1.24	31.4 1.2	-0.11	-0.0887
Bideltoid Diameter	17.88 - 18.99 ( 1.11 in)	18.32 0.94	18.5 0.9	0.18	0.1914
Buttock-knee Length	23.62 - 24.09 ( 0.47 in)	23.76 1.08	23.8 1.1	0.04	0.0370
Hip Breadth, Sitting	13.88 - 14.88 ( 1.00 in)	14.19 0.89	13.9 0.8	-0.29	-0.3258

\* n = 5

TABLE IV

COMPARISON OF USAARL 1969 WITH GRAND MEAN AND POOLED  
STANDARD DEVIATION OF THREE SELECTED ANTHROPOMETRIC SURVEYS<sup>1,5,6</sup>

	Range	$\bar{x}_G$ $s_G$ S.E.	USAARL 1969 n = 1640	$x - \bar{x}_G$	$x - \frac{\sum(\bar{x} n)}{\sum n}$ $s_G$
Age	29.16 - 30.37 (1.21)	29.75 5.81 (0.0869)	22.0 2.9	-7.55	-1.33
Weight	165.772 - 173.60 (7.83)	171.96 20.38 (0.3048)	164.0 18.7	-7.96	-0.39
Stature	69.497 - 69.74 (0.44)	69.82 2.38 (0.0356)	69.7 2.4	-0.12	-0.05
Functional Reach *	31.51 - 31.62 (0.11)	31.58 1.51 (0.0225)	31.4 1.5	-0.18	-0.12
Sitting Height	35.608 - 36.69 (1.08)	36.43 1.25 (0.0186)	36.2 1.3	-0.23	-0.18
Eye Height, Sitting	30.904 - 31.87 (0.97)	31.66 1.20 (0.0179)	31.4 1.2	-0.26	-0.22
Bideltoid Diameter	18.268 - 18.99 (0.72)	18.84 0.96 (0.0143)	18.5 0.9	-0.34	-0.35
Buttock-knee Length	23.78 - 24.09 (0.31)	23.89 1.04 (0.0155)	23.8 1.1	-0.09	-0.09
Hip Breadth, Sitting	14.187 - 14.88 (0.69)	14.67 0.88 (0.0131)	13.9 0.8	-0.77	-0.88

\* Reference 6 contains no measurement of "functional reach".



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## ANNEX I

```

// FOR
* NAME ANTCK
* ONE WORD INTEGERS
* IOCS(CARD,1132PRINTER)
* LIST ALL
* THIS PROGRAM IS TO CHECK THE ANTHROPOMETRIC DATA.
* TO USE THIS PROGRAM, PLACE 9 CARDS WITH THE REGRESSION COEFFICIENTS
* (B0 - B10) AND THE STANDARD ERROR OF THE ESTIMATE BEFORE THE DATA
* CARDS. THE LAST CARD OF THE DATA DECK MUST HAVE 99 IN COLUMNS 31-32
  DIMENSION A(9),NA(13),XBAR(9),M(9),INDEX(10),SD(9),C(9),B(9,11)
101 FORMAT(10F6.3,F3.3,F5.2)
102 FORMAT(8X,13A1,10X,F2.0,6X,F3.1)
103 FORMAT(1H0,13A1,9F10.3)
104 FORMAT(1H,13X,9F10.3,(/13X,9I10))
C READ THE REGRESSION COEFFICIENTS AND STANDARD ERROR OF THE ESTIMATE.
  DO 1 K = 1,9
    1 READ(2,101)(B(K,I),I = 1,11),SD(K)
C ZERO THE INDEX AND M FILES.
  25 DO 11 K = 1,9
    M(K) = 0
    11 INDEX(K) = 0
C READ A DATA CARD
  READ(7,102)(NA(I),I = 1,13),AGE,(A(N),N = 1,9)
C CHECK FOR THE LAST CARD.
  IF (AGE - 99.0)3,6,6
    3 IF(A(1) - 70.0)4,4,5
    4 A(1) = A(1) + 100.0
    5 IF(A(4) - 50.0)7,8,8
    7 A(4) = A(4) + 100.0
    8 A(2) = A(2) + 100.0
    IF(A(9) - 70.0)9,9,10
    9 A(8) = A(8) + 100.0
C PERFORM INITIAL CHECK. INDEX(1) = THE SUM OF (ABSOLUTE VALUE OF (A -
  XBAR / SE)), WHERE XBAR IS THE MEAN VALUE COMPUTED BY THE
C REGRESSION LINE FORMULA, AND SE IS THE STANDARD ERROR OF THE ESTIMATE.
  10 DO 2 K = 1,9
    CALL ACHEK(A,B,K,AGE,XBAR(K))
    2 INDEX(1) = INDEX(1) + ABS((A(K) - XBAR(K))/SD(K))
C IF INDEX(1) IS LESS THAN 45, READ ANOTHER CARD.
  IF (INDEX(1) - 45)25,25,12
C IF INDEX(1) IS GREATER THAN 45, PLACE THIS DATA CARD IN A SEPARATE BIN,
C AND COMPUTE A GOOD ESTIMATE FOR EACH A.
  12 CALL STACK
  DO 14 L = 10,18
    LL = L - 9
C SET INITIAL VALUE OF INDEX FILE 1 TO A HIGH VALUE.
    INDEX(LL) = 500
    N = 0
C REMEMBER PRESENT VALUE OF A.
    ATEMP = A(LL)
C DETERMINE IF A IS LARGER OR SMALLER THAN XBAR.
    CALL ACHEK(A,B,LL,AGE,XBAR(LL))
    IF (A(LL) - XBAR(LL))17,14,16
    17 AN = 1
    GO TO 18
    16 AN = -1
    18 DO 22 K = 1,9
      22 CALL ACHEK(A,B,K,AGE,XBAR(K))
      INDEX(L) = 0
      DO 26 K = 1,9
        C COMPUTE INDEX WITH CURRENT VALUE OF A.
        26 INDEX(L) = INDEX(L) + ABS((A(K) - XBAR(K))/SD(K))
        IF (INDEX(L))15,19,15
        C CHECK THAT THE CURRENT VALUE OF THE INDEX IS LESS THAN THE LAST VALUE.
        15 IF (INDEX(L) - INDEX(LL))23,19,19
        C CHANGE THE VALUE OF A BY 2 SE TOWARD XBAR.
        23 A(LL) = A(LL) + SD(LL) * AN * 2.0
        C REMEMBER THE CURRENT VALUE OF INDEX.
        INDEX(LL) = INDEX(L)
        N = N+1
C GO BACK AND COMPUTE NEW INDEX USING NEW VALUE OF A.
        GO TO 18
        19 C(LL) = A(LL)
        A(LL) = ATEMP
        M(LL) = N
        14 CONTINUE
C WRITE IDENTIFICATION OF THIS DATA CARD AND ORIGINAL VALUES OF A.
        WRITE(3,103)(NA(I),I = 1,13),(A(I),I = 1,9)
C WRITE BEST FIT VALUES OF A AND THE INDEX OF EACH.
        WRITE(3,104)(C(L),L=1,9),(M(L),L=1,9),(INDEX(L),L=1,9)
C GO BACK AND READ NEXT DATA CARD.
        GO TO 25
        6 CALL EXIT
        END

```

## ANNEX II

AGE

MEAN	22.0
STANDARD DEVIATION	2.9
RANGE	17.0 - 38.0
PERCENTILES	

1TH	19.0
2ND	19.0
3RD	19.0
5TH	19.0
10TH	19.0
15TH	20.0
20TH	20.0
25TH	20.0
30TH	20.0
35TH	20.0
40TH	21.0
45TH	21.0
50TH	21.0
55TH	21.0
60TH	22.0
65TH	22.0
70TH	23.0
75TH	23.0
80TH	24.0
85TH	25.0
90TH	26.0
95TH	29.0
97TH	30.0
98TH	30.0
99TH	32.0

ALL MEASUREMENTS ARE IN KG, CM, OR L

THESE RESULTS WERE COMPUTED FROM MEASUREMENTS ON

# WEIGHT

MEAN 164.0  
STANDARD DEVIATION 18.7  
RANGE 110.0 - 229.3  
PERCENTILES

1TH	123.9
2ND	128.6
3RD	131.2
5TH	135.2
10TH	140.9
15TH	145.1
20TH	147.7
25TH	150.2
30TH	152.8
35TH	155.0
40TH	157.7
45TH	160.1
50TH	162.5
55TH	164.9
60TH	167.1
65TH	170.2
70TH	173.8
75TH	177.3
80TH	181.0
85TH	184.8
90TH	190.1
95TH	197.3
97TH	200.2
98TH	204.4
99TH	209.9

ALL MEASUREMENTS ARE IN POUNDS OR INCHES

# WEIGHT

MEAN	74.3
STANDARD DEVIATION	8.5
RANGE	49.9 - 104.0
PERCENTILES	

1TH	56.2
2ND	58.3
3RD	59.5
5TH	61.3
10TH	63.9
15TH	65.8
20TH	67.0
25TH	68.1
30TH	69.3
35TH	70.3
40TH	71.5
45TH	72.6
50TH	73.7
55TH	74.8
60TH	75.8
65TH	77.2
70TH	78.8
75TH	80.4
80TH	82.1
85TH	83.8
90TH	86.2
95TH	89.5
97TH	90.8
98TH	92.7
99TH	95.2

ALL MEASUREMENTS ARE IN KG, CM, OR L

## HEIGHT

MEAN	176.9
STANDARD DEVIATION	6.1
RANGE	156.2 - 195.7
PERCENTILES	

1TH	163.1
2ND	164.5
3RD	165.3
5TH	166.5
10TH	168.7
15TH	170.5
20TH	171.6
25TH	172.7
30TH	173.8
35TH	174.7
40TH	175.5
45TH	176.2
50TH	177.0
55TH	177.8
60TH	178.5
65TH	179.4
70TH	180.0
75TH	181.0
80TH	181.9
85TH	183.2
90TH	184.8
95TH	187.0
97TH	188.9
98TH	189.7
99TH	191.5

ALL MEASUREMENTS ARE IN KG, CM, OR L



## HEIGHT

MEAN	69.7
STANDARD DEVIATION	2.4
RANGE	61.5 - 77.0
PERCENTILES	

1TH	64.2
2ND	64.8
3RD	65.1
5TH	65.6
10TH	66.4
15TH	67.1
20TH	67.6
25TH	68.0
30TH	68.4
35TH	68.8
40TH	69.1
45TH	69.4
50TH	69.7
55TH	70.0
60TH	70.3
65TH	70.6
70TH	70.9
75TH	71.3
80TH	71.6
85TH	72.1
90TH	72.8
95TH	73.6
97TH	74.4
98TH	74.7
99TH	75.4

ALL MEASUREMENTS ARE IN POUNDS OR INCHES

# FUNCTIONAL ARM REACH

MEAN	79.8
STANDARD DEVIATION	3.8
RANGE	68.0 - 96.6
PERCENTILES	

1TH	70.7
2ND	71.7
3RD	72.6
5TH	73.5
10TH	75.0
15TH	75.9
20TH	76.5
25TH	77.3
30TH	77.8
35TH	78.2
40TH	78.8
45TH	79.4
50TH	79.7
55TH	80.2
60TH	80.6
65TH	81.2
70TH	81.7
75TH	82.3
80TH	83.0
85TH	83.7
90TH	84.7
95TH	86.3
97TH	87.5
98TH	88.3
99TH	89.4

ALL MEASUREMENTS ARE IN KG, CM, OR L

## FUNCTIONAL ARM REACH

MEAN	31.4
STANDARD DEVIATION	1.5
RANGE	26.8 - 38.0
PERCENTILES	

1TH	27.8
2ND	28.2
3RD	28.6
5TH	28.9
10TH	29.5
15TH	29.9
20TH	30.1
25TH	30.4
30TH	30.6
35TH	30.8
40TH	31.0
45TH	31.3
50TH	31.4
55TH	31.6
60TH	31.7
65TH	32.0
70TH	32.2
75TH	32.4
80TH	32.7
85TH	33.0
90TH	33.3
95TH	34.0
97TH	34.4
98TH	34.8
99TH	35.2

ALL MEASUREMENTS ARE IN POUNDS OR INCHES

# SITTING HEIGHT

MEAN	91.8
STANDARD DEVIATION	3.2
RANGE	81.0 - 102.8
PERCENTILES	

1TH	83.7
2ND	84.6
3RD	85.2
5TH	86.3
10TH	87.6
15TH	88.5
20TH	89.2
25TH	89.9
30TH	90.3
35TH	90.7
40TH	91.1
45TH	91.5
50TH	91.9
55TH	92.3
60TH	92.8
65TH	93.2
70TH	93.6
75TH	94.0
80TH	94.6
85TH	95.2
90TH	96.0
95TH	97.1
97TH	97.9
98TH	98.5
99TH	99.4

ALL MEASUREMENTS ARE IN KG, CM, OR L

## SITTING HEIGHT

MEAN	36.2
STANDARD DEVIATION	1.3
RANGE	31.9 - 40.5
PERCENTILES	

1TH	33.0
2ND	33.3
3RD	33.5
5TH	34.0
10TH	34.5
15TH	34.8
20TH	35.1
25TH	35.4
30TH	35.6
35TH	35.7
40TH	35.9
45TH	36.0
50TH	36.2
55TH	36.3
60TH	36.5
65TH	36.7
70TH	36.9
75TH	37.0
80TH	37.2
85TH	37.5
90TH	37.8
95TH	38.2
97TH	38.5
98TH	38.8
99TH	39.1

ALL MEASUREMENTS ARE IN POUNDS OR INCHES

# SITTING EYE HEIGHT

MEAN	79.6
STANDARD DEVIATION	3.0
RANGE	68.6 - 92.8
PERCENTILES	

1TH	72.5
2ND	73.3
3RD	73.8
5TH	74.6
10TH	75.8
15TH	76.6
20TH	77.2
25TH	77.6
30TH	78.1
35TH	78.5
40TH	79.0
45TH	79.4
50TH	79.7
55TH	80.2
60TH	80.5
65TH	80.9
70TH	81.2
75TH	81.7
80TH	82.1
85TH	82.6
90TH	83.5
95TH	84.7
97TH	85.5
98TH	86.3
99TH	87.1

ALL MEASUREMENTS ARE IN KG, CM, OR L

## SITTING EYE HEIGHT

MEAN	31.4
STANDARD DEVIATION	1.2
RANGE	27.0 - 36.5
PERCENTILES	

1TH	28.5
2ND	28.9
3RD	29.1
5TH	29.4
10TH	29.8
15TH	30.2
20TH	30.4
25TH	30.6
30TH	30.7
35TH	30.9
40TH	31.1
45TH	31.3
50TH	31.4
55TH	31.6
60TH	31.7
65TH	31.9
70TH	32.0
75TH	32.2
80TH	32.3
85TH	32.5
90TH	32.9
95TH	33.3
97TH	33.7
98TH	34.0
99TH	34.3

ALL MEASUREMENTS ARE IN POUNDS OR INCHES

# BI-DELTOID DIAMETER

MEAN	47.0
STANDARD DEVIATION	2.3
RANGE	39.0 - 55.1
PERCENTILES	

1TH	41.5
2ND	42.3
3RD	42.7
5TH	43.2
10TH	44.0
15TH	44.6
20TH	45.0
25TH	45.4
30TH	45.7
35TH	46.0
40TH	46.4
45TH	46.6
50TH	47.0
55TH	47.3
60TH	47.5
65TH	47.8
70TH	48.2
75TH	48.6
80TH	49.0
85TH	49.5
90TH	50.2
95TH	51.0
97TH	51.7
98TH	52.2
99TH	52.8

ALL MEASUREMENTS ARE IN KG, CM, OR L



# BI-DELTOID DIAMETER

MEAN	18.5
STANDARD DEVIATION	0.9
RANGE	15.4 - 21.7
PERCENTILES	

1TH	16.3
2ND	16.7
3RD	16.8
5TH	17.0
10TH	17.3
15TH	17.6
20TH	17.7
25TH	17.9
30TH	18.0
35TH	18.1
40TH	18.3
45TH	18.3
50TH	18.5
55TH	18.6
60TH	18.7
65TH	18.8
70TH	19.0
75TH	19.1
80TH	19.3
85TH	19.5
90TH	19.8
95TH	20.1
97TH	20.4
98TH	20.6
99TH	20.8

ALL MEASUREMENTS ARE IN POUNDS OR INCHES

# BUTTOCK-KNEE LENGTH

MEAN	60.3
STANDARD DEVIATION	2.6
RANGE	51.4 - 71.4
PERCENTILES	

1TH	54.5
2ND	55.1
3RD	55.5
5TH	56.2
10TH	57.0
15TH	57.6
20TH	58.0
25TH	58.5
30TH	58.8
35TH	59.3
40TH	59.6
45TH	60.0
50TH	60.3
55TH	60.6
60TH	61.0
65TH	61.5
70TH	61.8
75TH	62.2
80TH	62.6
85TH	63.1
90TH	63.9
95TH	64.9
97TH	65.6
98TH	66.1
99TH	67.0

ALL MEASUREMENTS ARE IN KG, CM, OR L

## BUTTOCK-KNEE LENGTH

MEAN	23.8
STANDARD DEVIATION	1.1
RANGE	20.2 - 28.1
PERCENTILES	

1TH	21.5
2ND	21.7
3RD	21.9
5TH	22.1
10TH	22.4
15TH	22.7
20TH	22.8
25TH	23.0
30TH	23.1
35TH	23.3
40TH	23.5
45TH	23.6
50TH	23.7
55TH	23.9
60TH	24.0
65TH	24.2
70TH	24.3
75TH	24.5
80TH	24.6
85TH	24.8
90TH	25.2
95TH	25.6
97TH	25.8
98TH	26.0
99TH	26.4

ALL MEASUREMENTS ARE IN POUNDS OR INCHES

# HIP BREADTH

MEAN	35.3
STANDARD DEVIATION	2.0
RANGE	29.5 - 44.1
PERCENTILES	

1TH	30.6
2ND	31.5
3RD	31.8
5TH	32.1
10TH	32.8
15TH	33.3
20TH	33.5
25TH	33.9
30TH	34.2
35TH	34.5
40TH	34.7
45TH	35.0
50TH	35.3
55TH	35.5
60TH	35.8
65TH	36.0
70TH	36.4
75TH	36.7
80TH	37.1
85TH	37.6
90TH	38.2
95TH	39.0
97TH	39.5
98TH	39.8
99TH	40.4

ALL MEASUREMENTS ARE IN KG, CM, OR L

## HIP BREADTH

MEAN	13.9
STANDARD DEVIATION	0.8
RANGE	11.6 - 17.4
PERCENTILES	

1TH	12.0
2ND	12.4
3RD	12.5
5TH	12.6
10TH	12.9
15TH	13.1
20TH	13.2
25TH	13.3
30TH	13.5
35TH	13.6
40TH	13.7
45TH	13.8
50TH	13.9
55TH	14.0
60TH	14.1
65TH	14.2
70TH	14.3
75TH	14.4
80TH	14.6
85TH	14.8
90TH	15.0
95TH	15.4
97TH	15.6
98TH	15.7
99TH	15.9

ALL MEASUREMENTS ARE IN POUNDS OR INCHES

# BUTTOCK-LEG LENGTH

MEAN	111.3
STANDARD DEVIATION	5.1
RANGE	93.9 - 127.9
PERCENTILES	

1TH	99.3
2ND	100.8
3RD	101.5
5TH	102.7
10TH	104.6
15TH	106.0
20TH	107.0
25TH	107.9
30TH	108.7
35TH	109.4
40TH	110.0
45TH	110.6
50TH	111.2
55TH	111.8
60TH	112.6
65TH	113.4
70TH	114.2
75TH	114.9
80TH	115.7
85TH	116.7
90TH	117.8
95TH	120.0
97TH	121.5
98TH	122.5
99TH	123.9

ALL MEASUREMENTS ARE IN KG, CM, OR L

# BUTTOCK-LEG LENGTH

MEAN	43.8
STANDARD DEVIATION	2.0
RANGE	37.0 - 50.4
PERCENTILES	

1TH	39.1
2ND	39.7
3RD	40.0
5TH	40.4
10TH	41.2
15TH	41.7
20TH	42.1
25TH	42.5
30TH	42.8
35TH	43.1
40TH	43.3
45TH	43.5
50TH	43.8
55TH	44.0
60TH	44.3
65TH	44.6
70TH	45.0
75TH	45.2
80TH	45.6
85TH	45.9
90TH	46.4
95TH	47.2
97TH	47.8
98TH	48.2
99TH	48.8

ALL MEASUREMENTS ARE IN POUNDS OR INCHES

## ANNEX III



[illegible]

AGE

38								1											
37																			
36																			
35							2				1								
34							1	1			1								
33									2	2				1					
32									1	1		1	1	1					
31							1	1	2		3	3	1	1					
30			1	4	1	3	4	4		3	8	3	2						
29					1	3	4	3	4	1	4	1	3				2		
28				1		1		2	5	2	2	4	1	2	1				
27	1		1	3	3	1	3	4	3	4	2	5	1	1	1				
26			1		1	2	5	1	3	8	7	6	4	2	2	1	1		
25	1		2	2	3	9	6	13	7	7	14	3	7	2	1	1	1		1
24			2	3	5	4	5	5	19	12	13	11	8	7	4	1	1		1
23			2	5	5	10	12	9	13	15	19	17	12	11	3	4	4	3	
22		2	2	5	8	10	13	21	25	32	31	22	17	14	4	4	2	3	
21			4	6	15	20	27	34	45	29	29	38	12	17	15	9	1	1	2
20		1	1	7	25	17	31	36	58	49	67	48	28	16	10	6	3		
19	1		1	1	5	8	12	15	15	25	35	25	10	15	14	6	3	3	
18									3	1	3	1		1		1	1	1	
17															1				

HEIGHT

N 1640

WEIGHT	156	166	176	186	196
104					1
103					
102				1	
101					1 1
100				1	
99					
98			1		1
97				2	
96			2	1	2
95				1 2	
94			1 1	1	1
93			3 1 2	5	2
92			3 1		2
91			2 3 1 2 2 3	2	
90		1 1	3 1 2 1 6 4 3	1 4	1 1
89			4 4 3 3 3	1 1	
88			3 2 2 1 2 5	1	1
87			1 8 6 6 7 3 1 3	1	1 1
86		1	1 2 4 5 2 3 3 4	1	
85	1	1	1 1 4 2 4 7 4 5 3	1 1	
84		2	1 2 2 7 5 5 9 3 3 2 2 2	2	1
83			1 2 1 10 8 8 7 7 1 2		
82		1 1 6 8 4 3 6 3 5 2 4			
81		2 2 2 2 6 10 8 5 1 1 3	2 1	1	
80		2 2 3 3 8 4 8 8 4 3	3 1		
79		1	2 3 6 5 10 7 10 4 2 3		
78			1 3 3 7 7 11 5 6 4 4		
77		1	1 3 3 5 2 13 7 5 7 2 1		
76			2 3 5 6 12 8 9 11 6 3 2		1
75	1 2	2 3 7 8 5 7 10 14 8 6 4 2 1		1	
74			3 7 3 10 9 17 10 5 6 4		
73		1 4 4 5 7 5 10 10 8 12 3		1	1
72			1 5 6 9 12 10 9 12 5 7 4 1	2	
71		2 5 7 5 9 9 8 11 5 7 4 1			
70		2 4 5 10 10 15 5 16 6 3 4 1		1	
69		3 4 4 10 7 14 7 5 6 3 2		1 2	
68		1 1 3 8 4 14 9 15 7 3 2		1	
67	1	6 5 3 8 9 8 7 9 5 2 1 1			
66	1	1 2 5 7 10 9 8 8 10 6 1 2 1		1	
65		1 2 1 7 5 8 3 11 2 3			
64	1	1 1 2 5 1 3 8 6 5 3		2	1
63			1 3 2 3 2 5 2 5 1 1 1		
62		3 1 5 2 4 6 4 1 5			
61			2 7 1 6 1 2 1 2	1	
60		1 2 3 2 2	3 1 2		1
59	1		1 2 2		1 1
58			4 2 1 1		
57		1 1 2 2	1 1		
56		1 2 2	1 1 1		
55		1	1 1		1
54					
53		1			
52		1	1		
51			1		
50		1			

HEIGHT	156	166	176	186	196
97				1	
96					
95					
94				1	
93					
92					1 1
91				1	
90				3	2 1 2 1 1
89					1 1 4 2 1
88				5 1	2 4 3 1 1
87				1 4 6 7 5	1 3
86			2 2	7 6 7 7 4	3 2 1 1 1
85		1	2 1 5 8 8 10 14	5 8 3 3 1 1	
84		2 3	2 2 7 8 15 8 15 13	5 5 1	
83			5 5 9 17 23 27 12 9	6 2 1 2	
82			3 7 8 16 18 36 26 9 9	5 4 1 1	
81		1 1 3 11 11 26 16 33 20 17 16	7 3 1		
80			1 5 8 17 32 27 26 26 13 9 3	3	
79		2 6 12 14 13 37 18 26 12 9 5 1 1			
78		2 4 13 11 19 19 31 34 24 11 4 1 1			
77		2 4 9 15 16 24 22 20 6 9 1 1			
76			4 10 20 25 17 15 10 3 1		
75		2 3 7 9 14 12 14 5 4 5 2 2			
74	1 1	2 7 9 8 2 8 2 3 3			
73	1	4 5 10 3 3 1 2 2 2			
72		1 1 3 5 7 3			
71			4 4 2 4 1	1	
70		1 1 1 2	1		
69		1			
68	1				

HEIGHT	156	166	176	186	196
103					1
102				2	1
101				2 1 1	
100				1 2 1 1 2	
99				1 2 5 6 1 3	
98			1 1 2 2 6 5 11 3 2 1		
97			1 6 7 10 10 12 2 3 1 1		
96		1	4 8 19 16 15 21 3 8 3 1		
95		2 5 11 12 31 25 28 13 5 6 1 1			
94		2 1 2 26 32 34 35 17 17 2 4 2			
93		2 7 17 21 40 35 27 9 8 3 2			
92	1	2 1 5 14 24 38 37 41 28 14 6 2			
91		1 5 15 13 29 56 28 23 22 5 4 2 1			
90		2 9 18 24 33 25 18 23 4 4 1			
89		1 4 11 19 22 20 18 10 6 3 1			
88		2 6 11 12 24 10 9 10 4 3			
87	1	1 5 16 8 12 7 3 3			
86	2	1 9 11 3 8 2 1 3			
85	2	5 7 3 7 1 1			
84		4 3 3 3 1 1			
83		1 1 4 1			
82		2 1 1 1			
81	1				

HEIGHT

N 1640

HEIGHT	156	166	176	186	196
93					1
92					
91					
90				1	1
89			1	1	1
88				2	2
87				2	2
86			1	3	3
85			2	2	5
84			1	2	9
83		1	1	10	12
82		1	1	4	23
81		4	10	17	28
80	1	1	1	2	6
79		2	5	16	20
78		1	4	11	18
77	1	1	6	13	17
76		2	5	15	9
75	2	1	12	12	10
74		4	2	5	8
73	1	4	3	7	5
72		3	2		
71	1	2			
70		1	2	1	
69	1				

HEIGHT	156	166	176	186	196
55				1	1
54			1	1	
53		1	1	5	1
52		1	3	2	3
51		2	1	3	11
50	1	2	4	6	8
49		2	1	5	5
48		2	4	6	15
47		2	5	13	17
46	1	1	5	9	12
45		1	4	5	13
44			2	4	13
43		1	3	5	8
42			1	2	2
41			1	3	
40					1
39					

[illegible]

	156	166	176	186	196
HEIGHT	CM				
N =	1640				



HEIGHT	156	166	176	186	196
44		1			
43					
42		1	1	1	
41			1	1	1
40		2	1	1	1
39	1	1	3	2	13
38		1	5	1	6
37		3	5	10	13
36	1	2	5	7	21
35	1	4	3	12	16
34		2	6	12	14
33	1	1	1	3	9
32		4	7	14	13
31		2	3	2	3
30	1	2	2	1	2
29					

-----

HEIGHT CM  
N = 1640

[illegible]

HEIGHT	156	166	176	186	196
128					1
127					1
126				1	
125				1	2
124				1	1
123				1	4
122				1	3
121				3	5
120			2	1	5
119			2	3	6
118			1	2	8
117			3	2	12
116			1	6	9
115			6	16	23
114		1	3	6	18
113		1	1	4	13
112		2	2	4	10
111			2	6	13
110		3	3	13	24
109		3	1	2	20
108		1	4	8	20
107		1	7	12	19
106		1	2	6	13
105	1	1	2	3	18
104		1	9	9	9
103		3	4	8	11
102		2	10	8	5
101		1	1	6	3
100		2	1	1	3
99	1	3	1	3	1
98		1	2	1	1
97					1
96					
95					
94			1		

WEIGHT	50	60	70	80	90	100
55						
54			1	1		
53					1	1
52				1	2	3
51			1	2	1	1
50		1	1	2	5	9
49			5	3	5	8
48		1	1	1	3	7
47			3	2	15	23
46		2	8	9	19	37
45		3	6	12	24	22
44		2	3	8	6	14
43	1	1	2	1	8	9
42		1	2	5	3	1
41	2		1	2	1	1
40		1				
39			1			

-----

WEIGHT KG

N = 1640

HIP BREADTH CM

[illegible]

50

60

70

80

90

100

WEIGHT KG

N = 1640

[illegible]

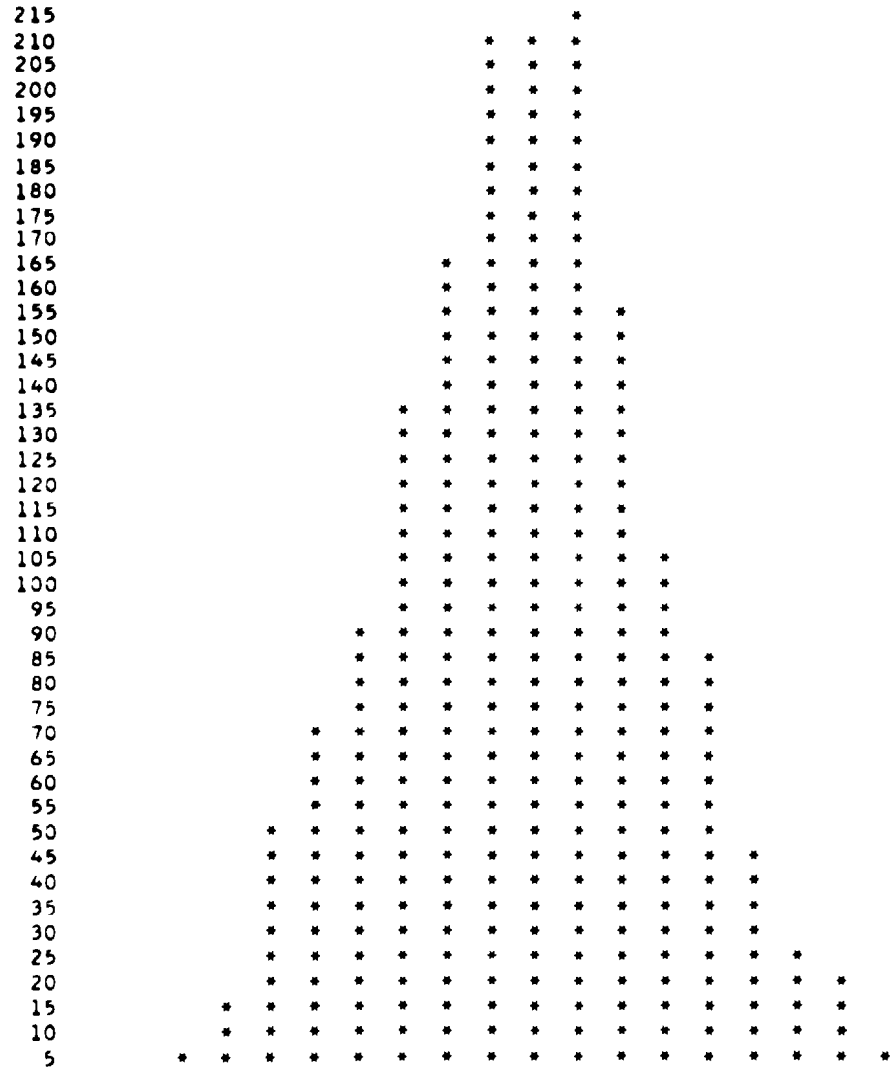
SITTING HEIGHT CM  
N = 1640

## ANNEX IV

# HISTOGRAM 1

FREQUENCY 2 18 74 136 214 216 107 48 20  
1 8 50 92 167 210 159 85 25 7

EACH \* EQUALS 5 POINTS



INTERVAL 1 = 157 OR LESS  
 INTERVAL 2 = 157 TO 159  
 INTERVAL 3 = 159 TO 161  
 INTERVAL 4 = 161 TO 163  
 INTERVAL 5 = 163 TO 165  
 INTERVAL 6 = 165 TO 167  
 INTERVAL 7 = 167 TO 169  
 INTERVAL 8 = 169 TO 171  
 INTERVAL 9 = 171 TO 173  
 INTERVAL 10 = 173 TO 175  
 INTERVAL 11 = 175 TO 177  
 INTERVAL 12 = 177 TO 179  
 INTERVAL 13 = 179 TO 181  
 INTERVAL 14 = 181 TO 183  
 INTERVAL 15 = 183 TO 185  
 INTERVAL 16 = 185 TO 187  
 INTERVAL 17 = 187 TO 189  
 INTERVAL 18 = 189 TO 191  
 INTERVAL 19 = 191 TO 193  
 INTERVAL 20 = 193 TO 195

INTERVAL 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19  
 HEIGHT CM

# HISTOGRAM 2

FREQUENCY 12 403 215 101 44 21 33 5 3 0 1 0  
 1 194 304 144 80 33 26 12 5 3 0 0

EACH \* EQUALS 9 POINTS

396	*	INTERVAL 1 =	17OR LESS
387	*	INTERVAL 2 =	17 TO 18
378	*	INTERVAL 3 =	18 TO 19
369	*	INTERVAL 4 =	19 TO 20
360	*	INTERVAL 5 =	20 TO 21
351	*	INTERVAL 6 =	21 TO 22
342	*	INTERVAL 7 =	22 TO 23
333	*	INTERVAL 8 =	23 TO 24
324	*	INTERVAL 9 =	24 TO 25
315	*	INTERVAL 10 =	25 TO 26
306	*	INTERVAL 11 =	26 TO 27
297	*	INTERVAL 12 =	27 TO 28
288	*	INTERVAL 13 =	28 TO 29
279	*	INTERVAL 14 =	29 TO 30
270	*	INTERVAL 15 =	30 TO 31
261	*	INTERVAL 16 =	31 TO 32
252	*	INTERVAL 17 =	32 TO 33
243	*	INTERVAL 18 =	33 TO 34
234	*	INTERVAL 19 =	34 TO 35
225	*	INTERVAL 20 =	35 TO 36
216	*	INTERVAL 21 =	36 TO 37
207	*	INTERVAL 22 =	37 TO 38
198	*	INTERVAL 23 =	38 TO 39
189	*		
180	*		
171	*		
162	*		
153	*		
144	*		
135	*		
126	*		
117	*		
108	*		
99	*		
90	*		
81	*		
72	*		
63	*		
54	*		
45	*		
36	*		
27	*		
18	*		
9	*		

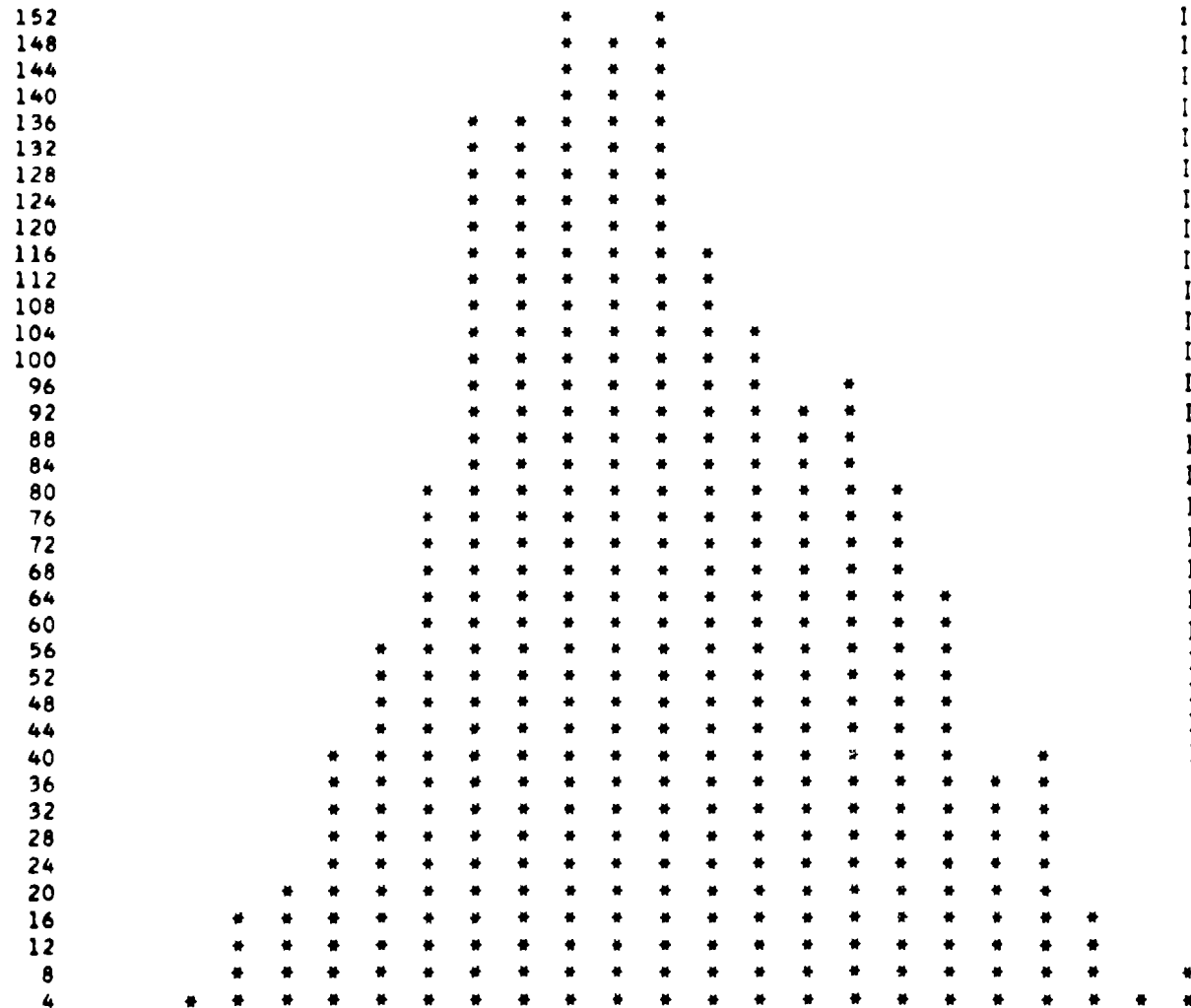
INTERVAL 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24  
 AGE



# HISTOGRAM 3

FREQUENCY 3 16 40 83 136 151 118 95 81 36 19 8 3 0  
2 4 22 57 137 155 155 104 97 64 43 7 2 1 0 1

EACH \* EQUALS 4 POINTS



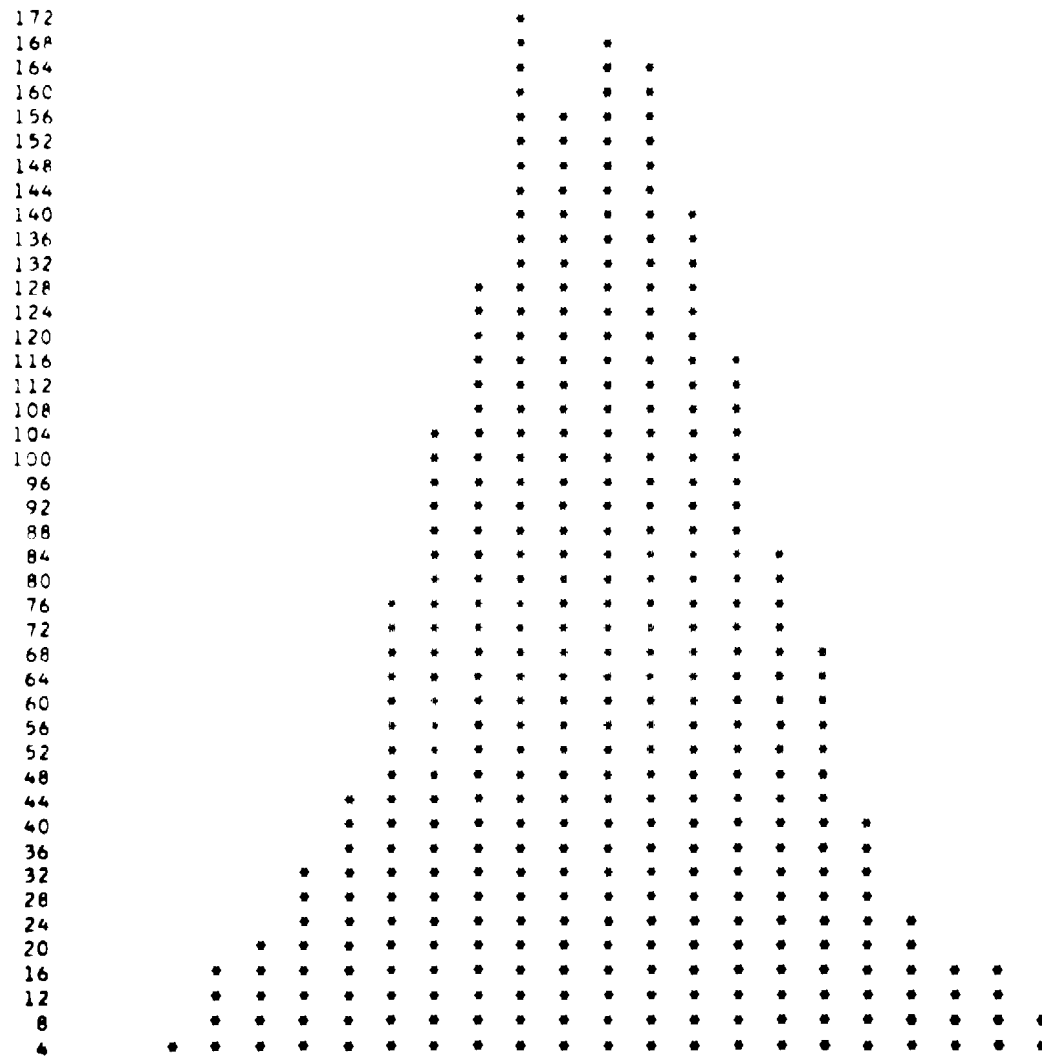
INTERVAL 1 = 500R LESS  
INTERVAL 2 = 50 TO 52  
INTERVAL 3 = 52 TO 54  
INTERVAL 4 = 54 TO 56  
INTERVAL 5 = 56 TO 58  
INTERVAL 6 = 58 TO 60  
INTERVAL 7 = 60 TO 62  
INTERVAL 8 = 62 TO 64  
INTERVAL 9 = 64 TO 66  
INTERVAL 10 = 66 TO 68  
INTERVAL 11 = 68 TO 70  
INTERVAL 12 = 70 TO 72  
INTERVAL 13 = 72 TO 74  
INTERVAL 14 = 74 TO 76  
INTERVAL 15 = 76 TO 78  
INTERVAL 16 = 78 TO 80  
INTERVAL 17 = 80 TO 82  
INTERVAL 18 = 82 TO 84  
INTERVAL 19 = 84 TO 86  
INTERVAL 20 = 86 TO 88  
INTERVAL 21 = 88 TO 90  
INTERVAL 22 = 90 TO 92  
INTERVAL 23 = 92 TO 94  
INTERVAL 24 = 94 TO 96  
INTERVAL 25 = 96 TO 98  
INTERVAL 26 = 98 TO 100  
INTERVAL 27 = 100 TO 102  
INTERVAL 28 = 102 TO 104

INTERVAL  
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29  
WEIGHT KG

# HISTOGRAM 4

FREQUENCY 1 16 32 79 129 156 166 118 70 27 16 1 0 0 1 0  
1 6 20 46 106 174 170 143 86 43 19 10 2 1 0 0

EACH \* EQUALS 4 POINTS



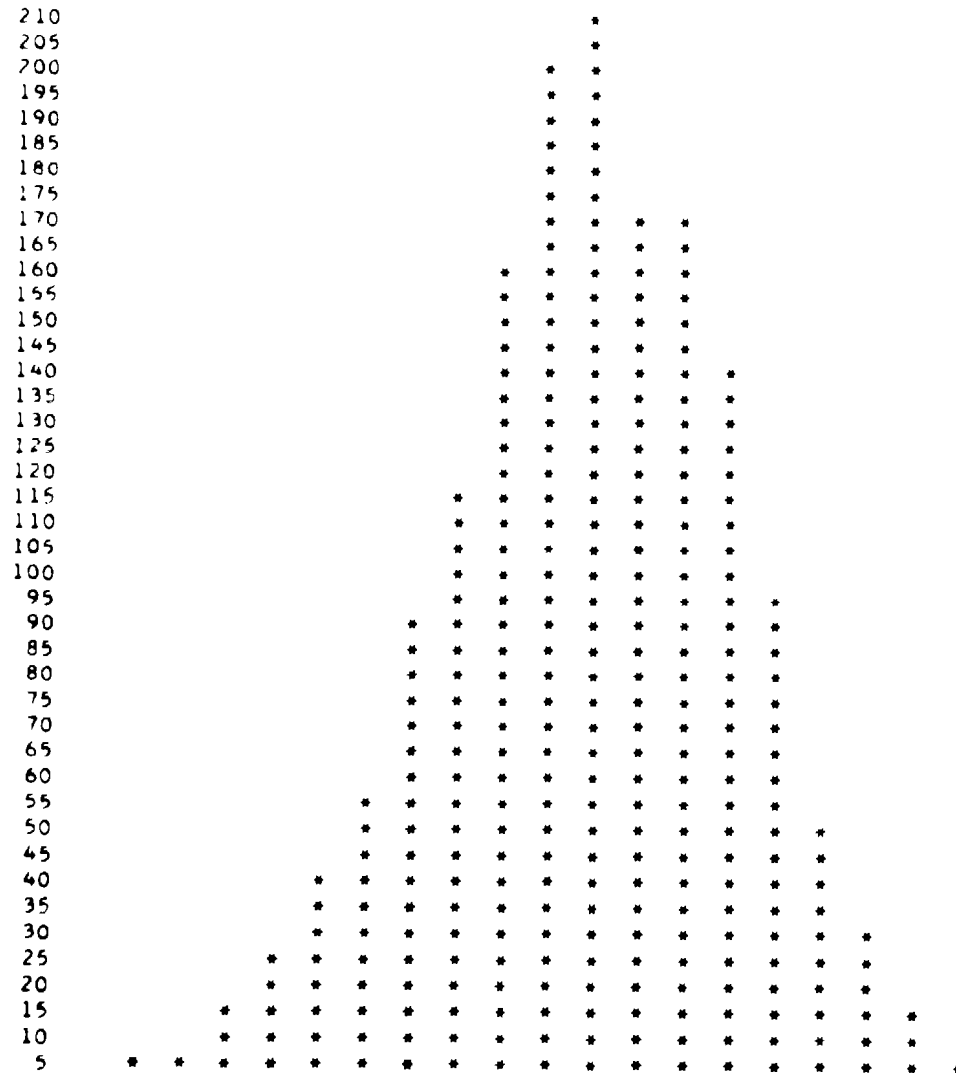
INTERVAL 1 = 290R LESS  
INTERVAL 2 = 29 TO 30  
INTERVAL 3 = 30 TO 31  
INTERVAL 4 = 31 TO 32  
INTERVAL 5 = 32 TO 33  
INTERVAL 6 = 33 TO 34  
INTERVAL 7 = 34 TO 35  
INTERVAL 8 = 35 TO 36  
INTERVAL 9 = 36 TO 37  
INTERVAL 10 = 37 TO 38  
INTERVAL 11 = 38 TO 39  
INTERVAL 12 = 39 TO 40  
INTERVAL 13 = 40 TO 41  
INTERVAL 14 = 41 TO 42  
INTERVAL 15 = 42 TO 43  
INTERVAL 16 = 43 TO 44  
INTERVAL 17 = 44 TO 45

INTERVAL  
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32  
FUNCTIONAL ARM REACH CM

# HISTOGRAM 5

FREQUENCY 5 15 40 91 161 213 174 99 34 7 3 0 0  
1 7 26 56 115 204 172 140 53 19 4 1 0

EACH \* EQUALS 5 POINTS



INTERVAL 1 =	81 OR LESS
INTERVAL 2 =	81 TO 82
INTERVAL 3 =	82 TO 83
INTERVAL 4 =	83 TO 84
INTERVAL 5 =	84 TO 85
INTERVAL 6 =	85 TO 86
INTERVAL 7 =	86 TO 87
INTERVAL 8 =	87 TO 88
INTERVAL 9 =	88 TO 89
INTERVAL 10 =	89 TO 90
INTERVAL 11 =	90 TO 91
INTERVAL 12 =	91 TO 92
INTERVAL 13 =	92 TO 93
INTERVAL 14 =	93 TO 94
INTERVAL 15 =	94 TO 95
INTERVAL 16 =	95 TO 96
INTERVAL 17 =	96 TO 97
INTERVAL 18 =	97 TO 98
INTERVAL 19 =	98 TO 99
INTERVAL 20 =	99 TO 100
INTERVAL 21 =	100 TO 101
INTERVAL 22 =	101 TO 102
INTERVAL 23 =	102 TO 103
INTERVAL 24 =	103 TO 104

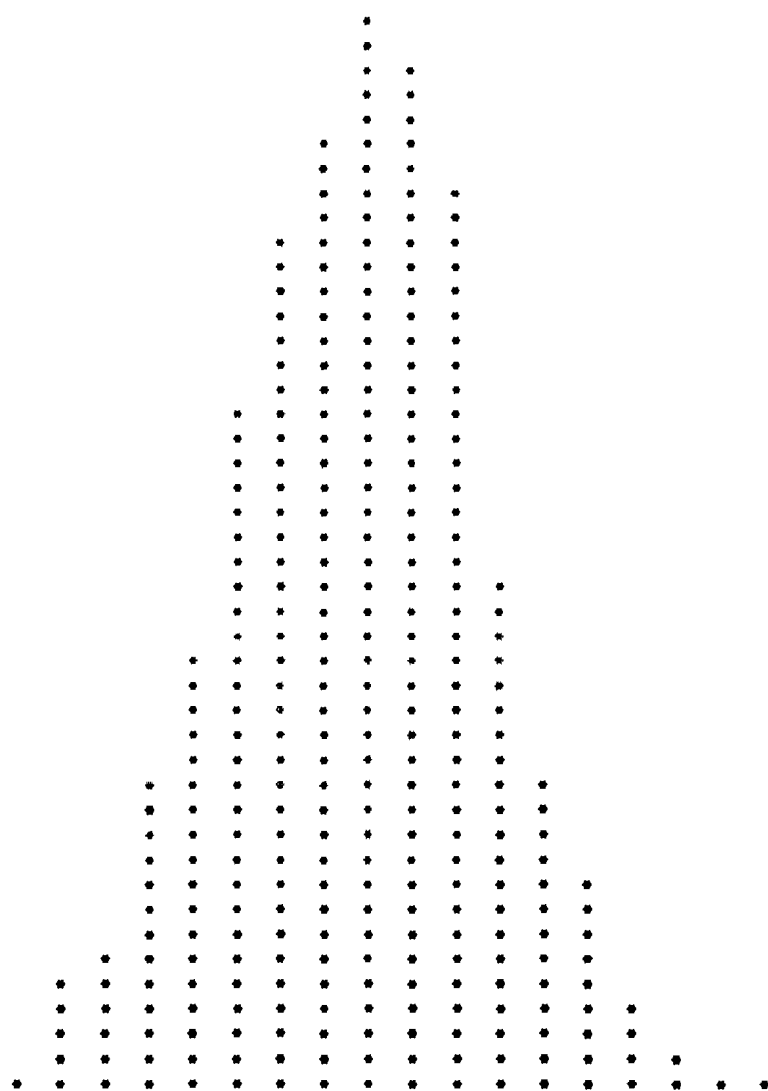
INTERVAL 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25  
SITTING HEIGHT CM

# HISTOGRAM 6

FREQUENCY 1 4 25 67 143 198 212 107 48 12 5 0 1 0

EACH \* EQUALS 5 POINTS

220  
215  
210  
205  
200  
195  
190  
185  
180  
175  
170  
165  
160  
155  
150  
145  
140  
135  
130  
125  
120  
115  
110  
105  
100  
95  
90  
85  
80  
75  
70  
65  
60  
55  
50  
45  
40  
35  
30  
25  
20  
15  
10  
5



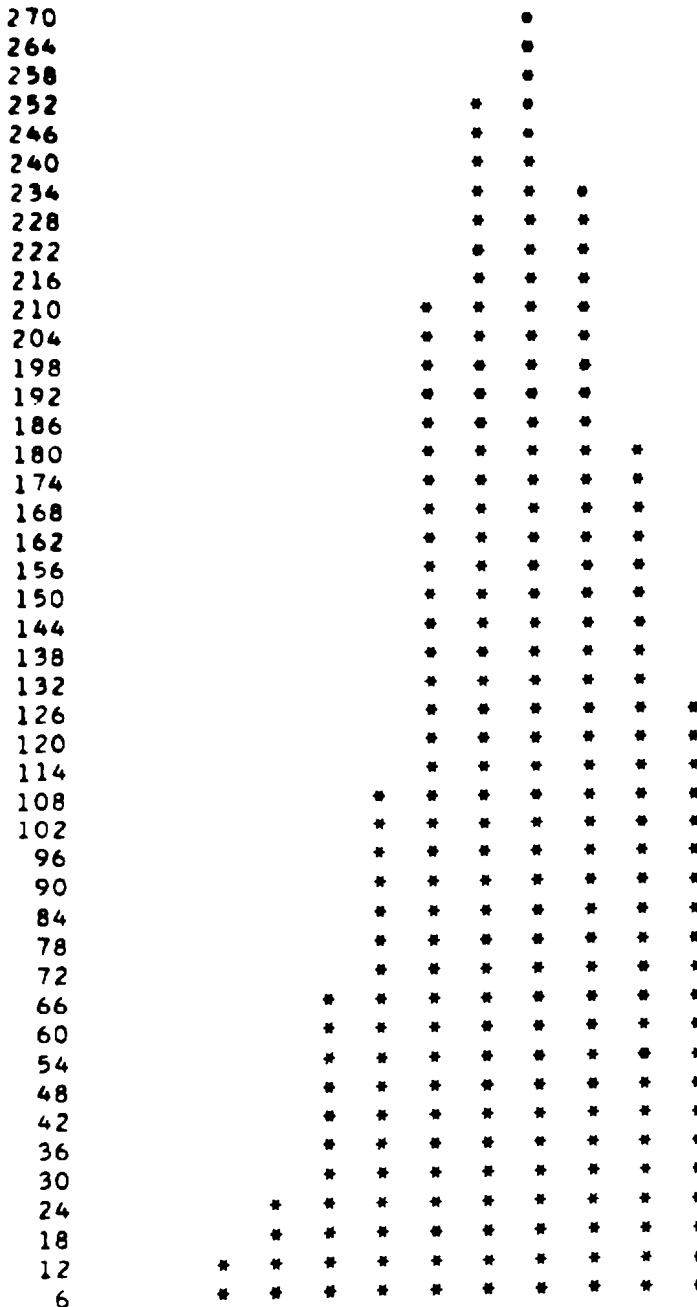
INTERVAL 1 = 68 OR LESS  
INTERVAL 2 = 68 TO 69  
INTERVAL 3 = 69 TO 70  
INTERVAL 4 = 70 TO 71  
INTERVAL 5 = 71 TO 72  
INTERVAL 6 = 72 TO 73  
INTERVAL 7 = 73 TO 74  
INTERVAL 8 = 74 TO 75  
INTERVAL 9 = 75 TO 76  
INTERVAL 10 = 76 TO 77  
INTERVAL 11 = 77 TO 78  
INTERVAL 12 = 78 TO 79  
INTERVAL 13 = 79 TO 80  
INTERVAL 14 = 80 TO 81  
INTERVAL 15 = 81 TO 82  
INTERVAL 16 = 82 TO 83  
INTERVAL 17 = 83 TO 84  
INTERVAL 18 = 84 TO 85  
INTERVAL 19 = 85 TO 86  
INTERVAL 20 = 86 TO 87  
INTERVAL 21 = 87 TO 88  
INTERVAL 22 = 88 TO 89  
INTERVAL 23 = 89 TO 90  
INTERVAL 24 = 90 TO 91  
INTERVAL 25 = 91 TO 92  
INTERVAL 26 = 92 TO 93  
INTERVAL 27 = 93 TO 94

INTERVAL 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28  
SITTING EYE HEIGHT CM

# HISTOGRAM 7

FREQUENCY 1 24 111 255 236 127 40 4 0  
1 12 70 211 273 181 76 16 1 1

EACH \* EQUALS 6 POINTS



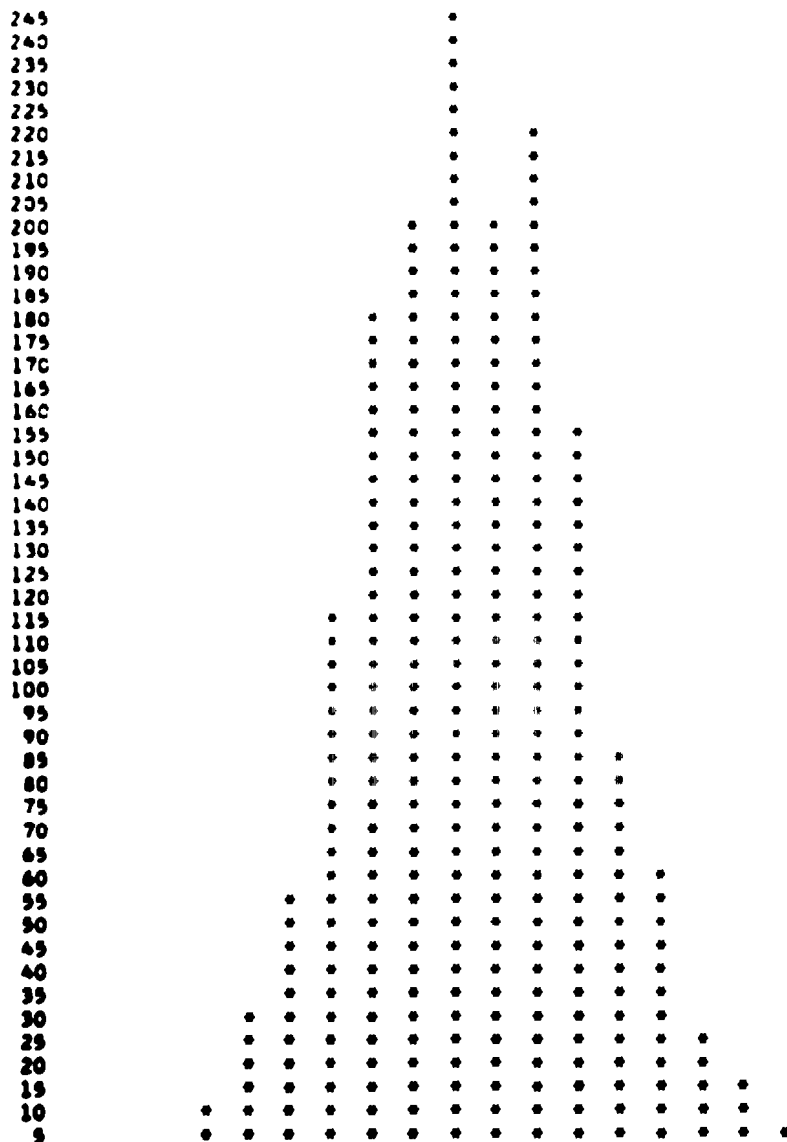
INTERVAL 1 = 39 OR LESS  
INTERVAL 2 = 39 TO 40  
INTERVAL 3 = 40 TO 41  
INTERVAL 4 = 41 TO 42  
INTERVAL 5 = 42 TO 43  
INTERVAL 6 = 43 TO 44  
INTERVAL 7 = 44 TO 45  
INTERVAL 8 = 45 TO 46  
INTERVAL 9 = 46 TO 47  
INTERVAL 10 = 47 TO 48  
INTERVAL 11 = 48 TO 49  
INTERVAL 12 = 49 TO 50  
INTERVAL 13 = 50 TO 51  
INTERVAL 14 = 51 TO 52  
INTERVAL 15 = 52 TO 53  
INTERVAL 16 = 53 TO 54  
INTERVAL 17 = 54 TO 55  
INTERVAL 18 = 55 TO 56

INTERVAL 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19  
BI-DELTOID DIAMETER CM

# HISTOGRAM 8

FREQUENCY 3 11 58 184 249 224 85 26 8 0 0  
1 0 32 116 204 203 155 62 18 0 1

EACH • EQUALS 5 POINTS



INTERVAL	1	=	51	OR	LESS
INTERVAL	2	=	51	TO	52
INTERVAL	3	=	52	TO	53
INTERVAL	4	=	53	TO	54
INTERVAL	5	=	54	TO	55
INTERVAL	6	=	55	TO	56
INTERVAL	7	=	56	TO	57
INTERVAL	8	=	57	TO	58
INTERVAL	9	=	58	TO	59
INTERVAL	10	=	59	TO	60
INTERVAL	11	=	60	TO	61
INTERVAL	12	=	61	TO	62
INTERVAL	13	=	62	TO	63
INTERVAL	14	=	63	TO	64
INTERVAL	15	=	64	TO	65
INTERVAL	16	=	65	TO	66
INTERVAL	17	=	66	TO	67
INTERVAL	18	=	67	TO	68
INTERVAL	19	=	68	TO	69
INTERVAL	20	=	69	TO	70
INTERVAL	21	=	70	TO	71
INTERVAL	22	=	71	TO	72

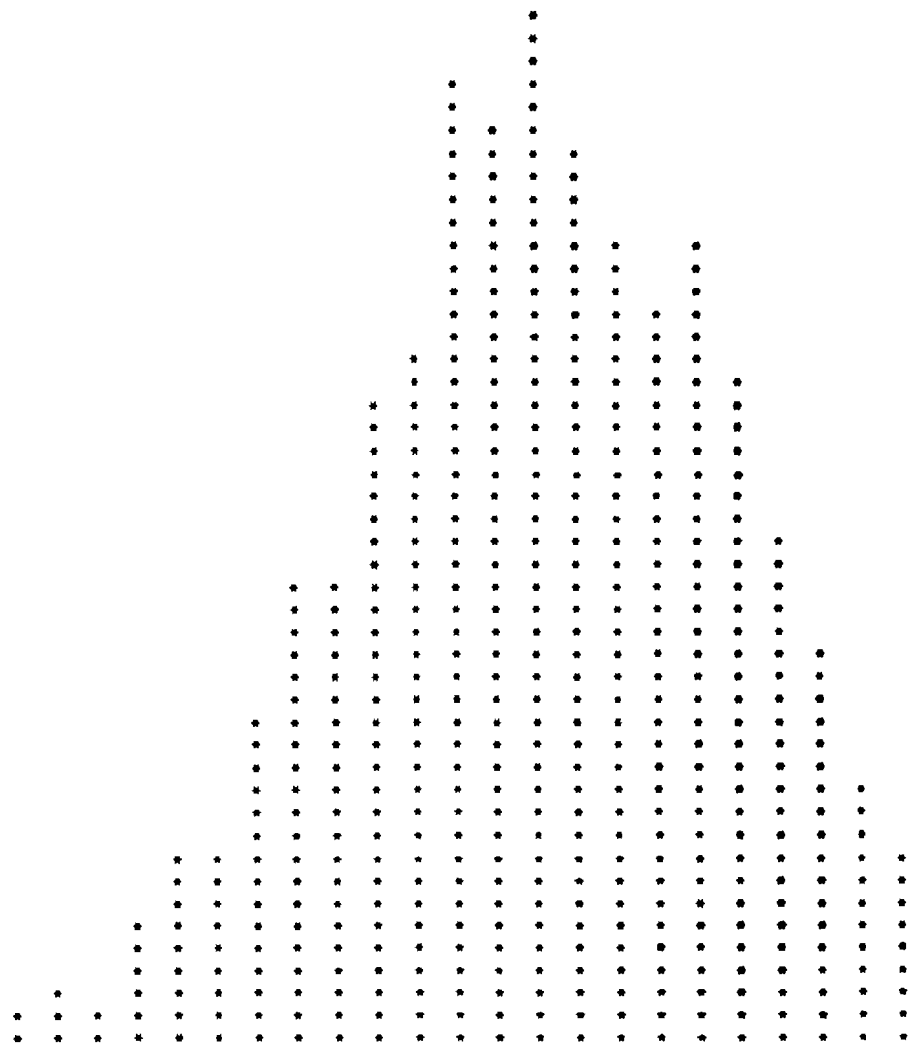
INTERVAL 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21  
BUTTOCK-KNEE LENGTH CM

# HISTOGRAM 9

FREQUENCY 1 0 0 7 8 28 46 65 93 125 120 99 92 56 28 17 7 3 2  
0 0 1 9 18 29 63 88 129 140 109 109 71 38 16 16 6 1

EACH \* EQUALS 3 POINTS

138  
135  
132  
129  
126  
123  
120  
117  
114  
111  
108  
105  
102  
99  
96  
93  
90  
87  
84  
81  
78  
75  
72  
69  
66  
63  
60  
57  
54  
51  
48  
45  
42  
39  
36  
33  
30  
27  
24  
21  
18  
15  
12  
9  
6  
3



INTERVAL 1 = 93 OR LESS  
INTERVAL 2 = 93 TO 94  
INTERVAL 3 = 94 TO 95  
INTERVAL 4 = 95 TO 96  
INTERVAL 5 = 96 TO 97  
INTERVAL 6 = 97 TO 98  
INTERVAL 7 = 98 TO 99  
INTERVAL 8 = 99 TO 100  
INTERVAL 9 = 100 TO 101  
INTERVAL 10 = 101 TO 102  
INTERVAL 11 = 102 TO 103  
INTERVAL 12 = 103 TO 104  
INTERVAL 13 = 104 TO 105  
INTERVAL 14 = 105 TO 106  
INTERVAL 15 = 106 TO 107  
INTERVAL 16 = 107 TO 108  
INTERVAL 17 = 108 TO 109  
INTERVAL 18 = 109 TO 110  
INTERVAL 19 = 110 TO 111  
INTERVAL 20 = 111 TO 112  
INTERVAL 21 = 112 TO 113  
INTERVAL 22 = 113 TO 114  
INTERVAL 23 = 114 TO 115  
INTERVAL 24 = 115 TO 116  
INTERVAL 25 = 116 TO 117  
INTERVAL 26 = 117 TO 118  
INTERVAL 27 = 118 TO 119  
INTERVAL 28 = 119 TO 120  
INTERVAL 29 = 120 TO 121  
INTERVAL 30 = 121 TO 122  
INTERVAL 31 = 122 TO 123  
INTERVAL 32 = 123 TO 124  
INTERVAL 33 = 124 TO 125  
INTERVAL 34 = 125 TO 126  
INTERVAL 35 = 126 TO 127  
INTERVAL 36 = 127 TO 128  
INTERVAL 37 = 128 TO 129

INTERVAL 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36  
BUTTOCK-LEG LENGTH CM

## HISTOGRAM 10

FREQUENCY	9	83	289	302	130	37	4	0	1
	0	21	171	298	199	86	10	0	0

EACH \* EQUALS 7 POINTS

[illegible][illegible]



## ANNEX V

For  $n = 1000$

$$r_{0.95} = 0.052$$

$$r_{0.975} = 0.062$$

$$r_{0.99} = 0.074$$

$$r_{0.995} = 0.081$$

$$r_{0.9995} = 0.104$$

IN THE FOLLOWING LISTING OF CORRELATION COEFFICIENTS  
VARIABLE

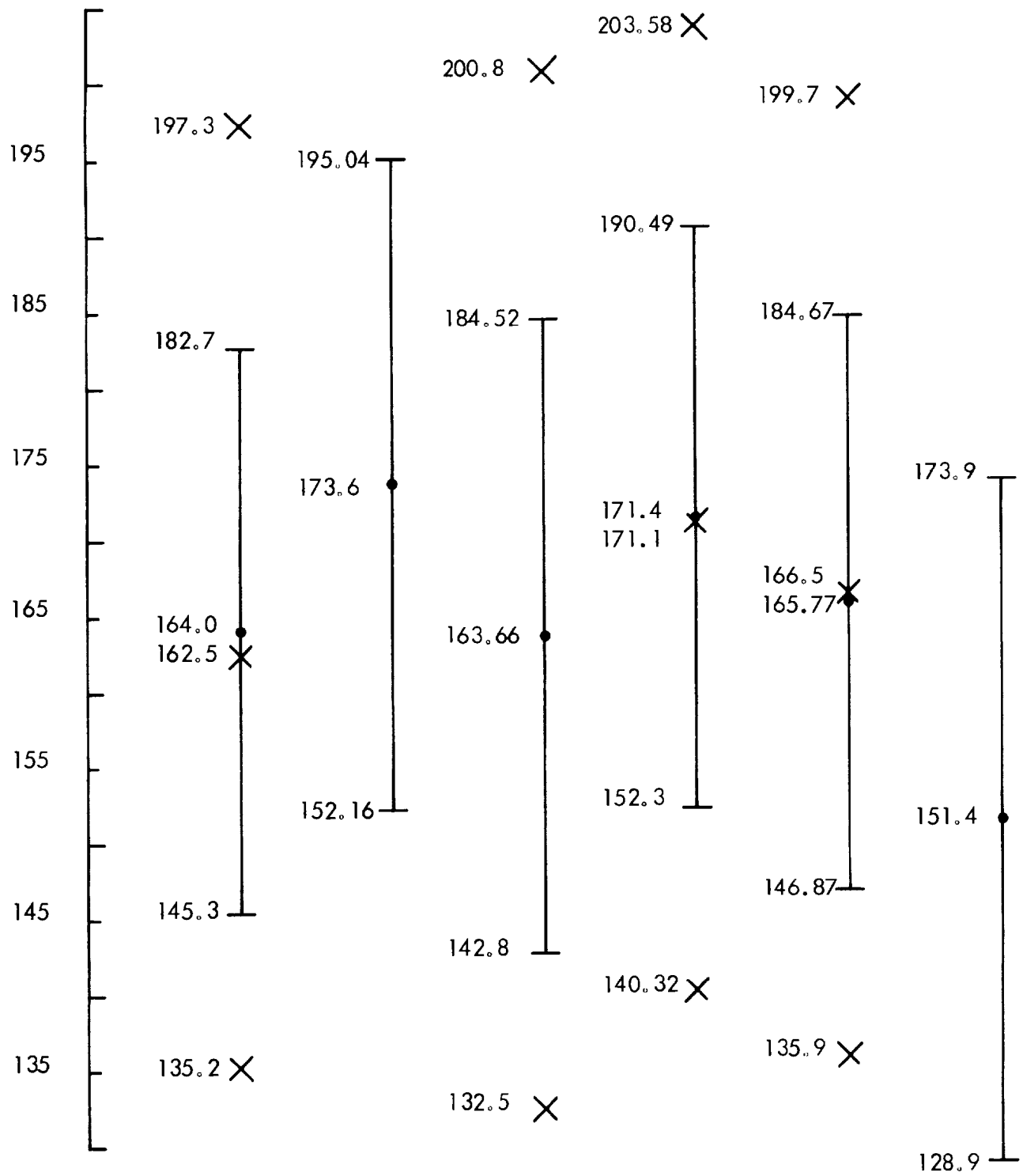
- 1 = HEIGHT CM
- 2 = AGE
- 3 = WEIGHT KG
- 4 = FUNCTIONAL ARM REACH CM
- 5 = SITTING HEIGHT CM
- 6 = SITTING EYE HEIGHT CM
- 7 = BI-DELTOID DIAMETER CM
- 8 = BUTTOCK-KNEE LENGTH CM
- 9 = BUTTOCK-LEG LENGTH CM
- 10 = HIP BREADTH CM

CORRELATION COEFFICIENTS

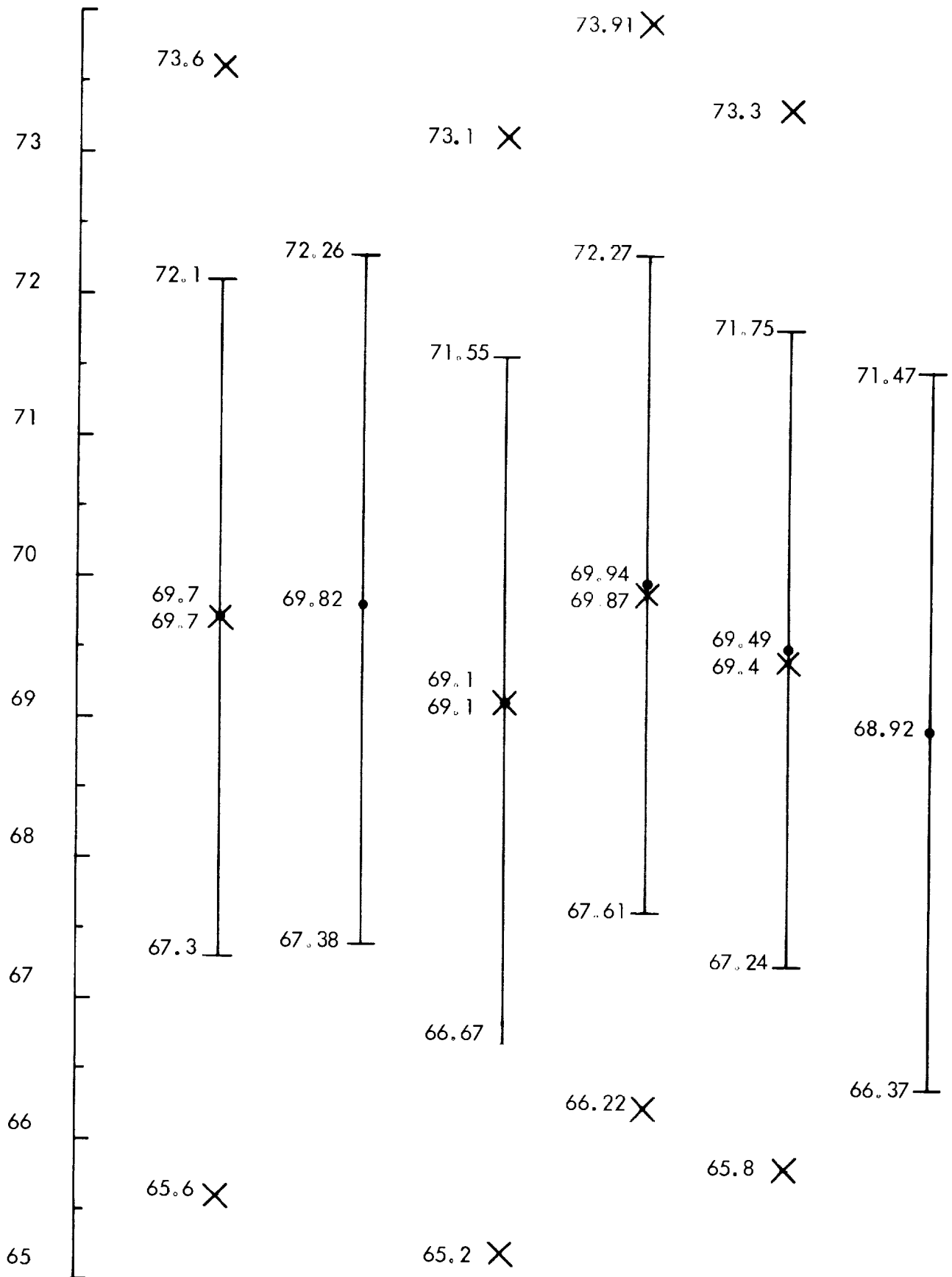
VARIABLE	1	2	3	4	5	6	7	8	9	10
1	1.00									
2	-0.04	1.00								
3	0.46	0.07	1.00							
4	0.65	0.01	0.39	1.00						
5	0.75	-0.04	0.42	0.41	1.00					
6	0.70	-0.01	0.39	0.34	0.92	1.00				
7	0.25	0.04	0.76	0.29	0.26	0.24	1.00			
8	0.79	-0.02	0.56	0.60	0.40	0.34	0.33	1.00		
9	0.85	-0.00	0.44	0.63	0.45	0.43	0.24	0.80	1.00	
10	0.34	0.08	0.83	0.32	0.36	0.33	0.62	0.45	0.30	1.00

## ANNEX VI

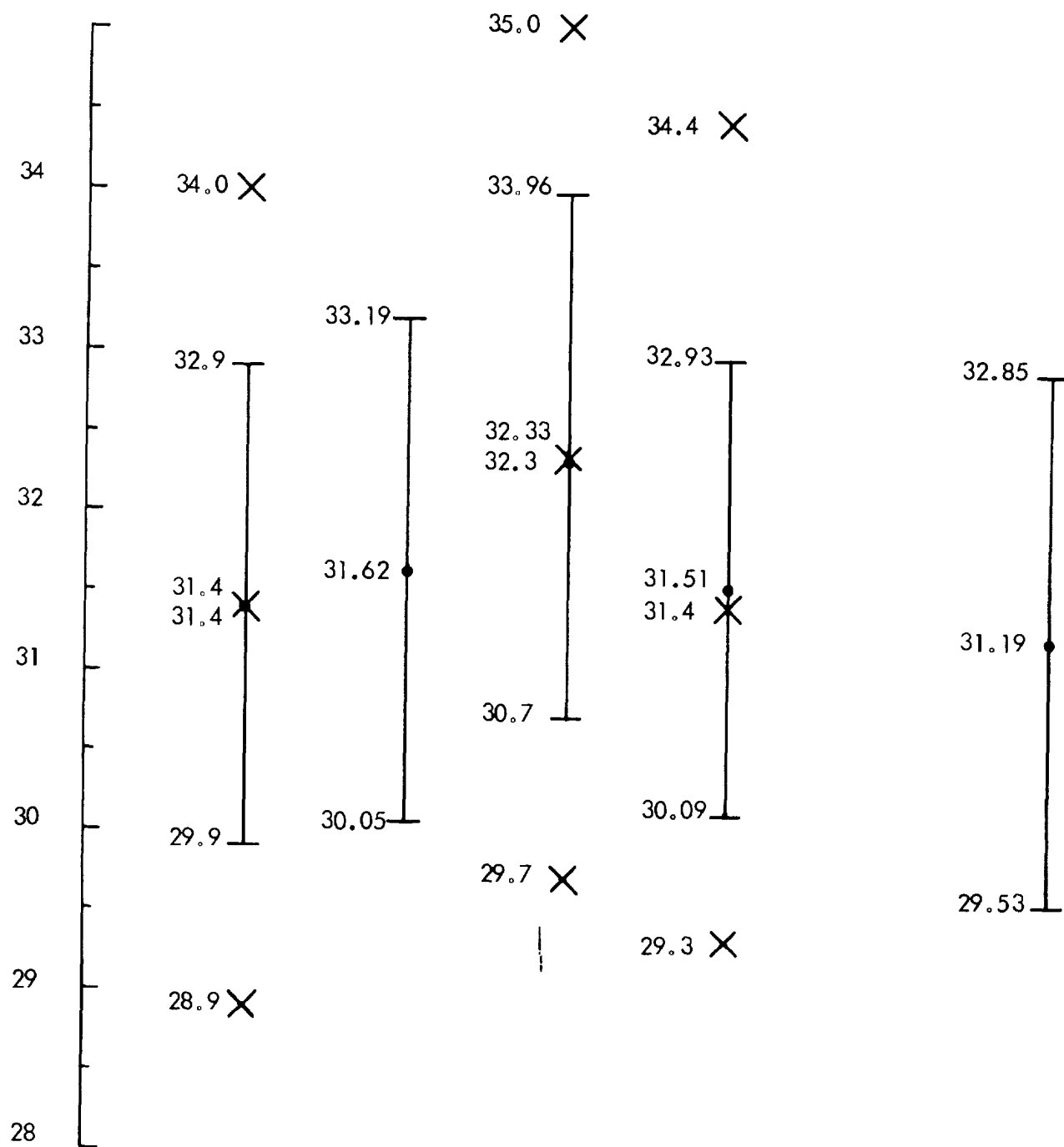
# WEIGHT



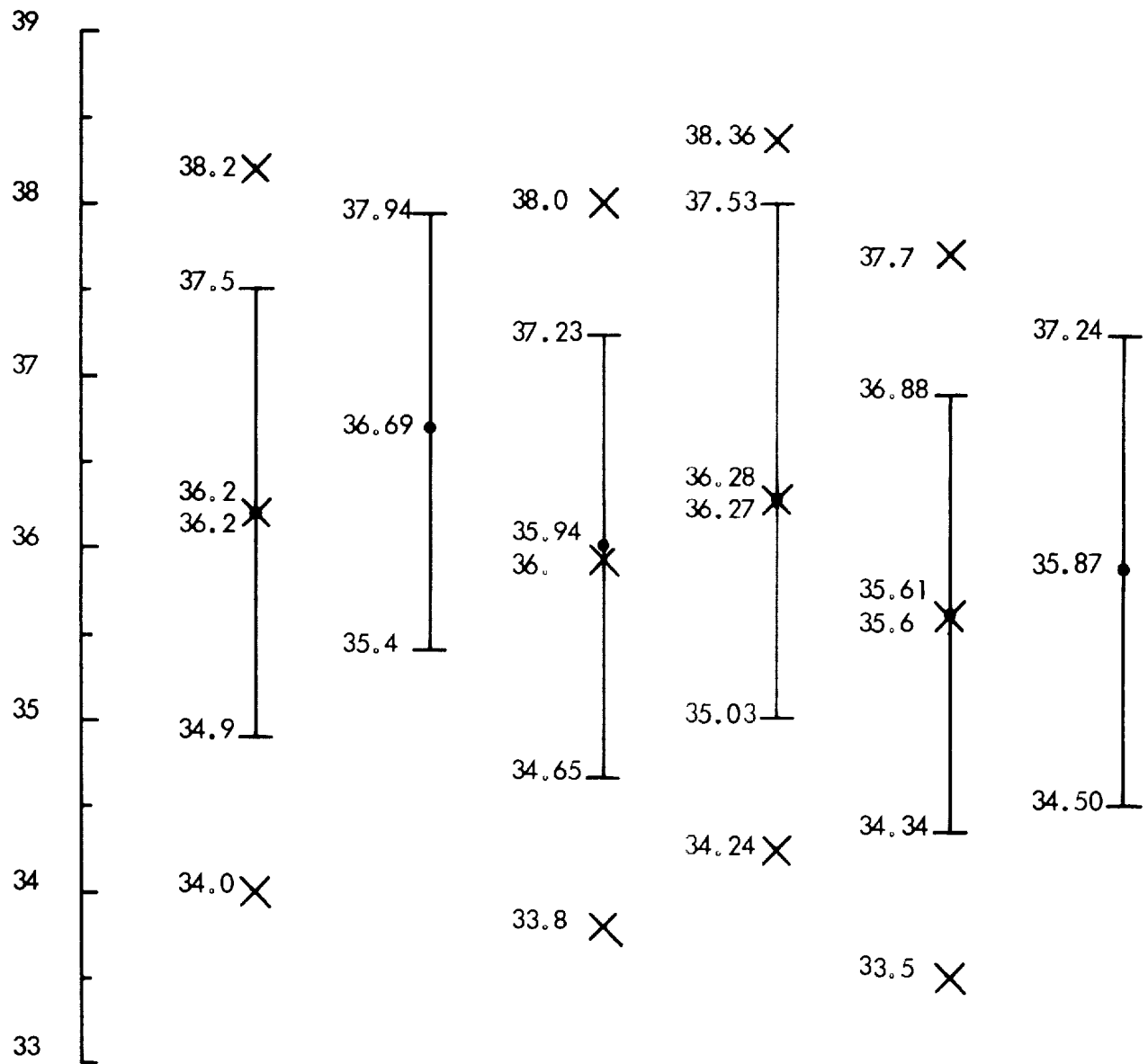
# HEIGHT



# FUNCTIONAL ARM REACH

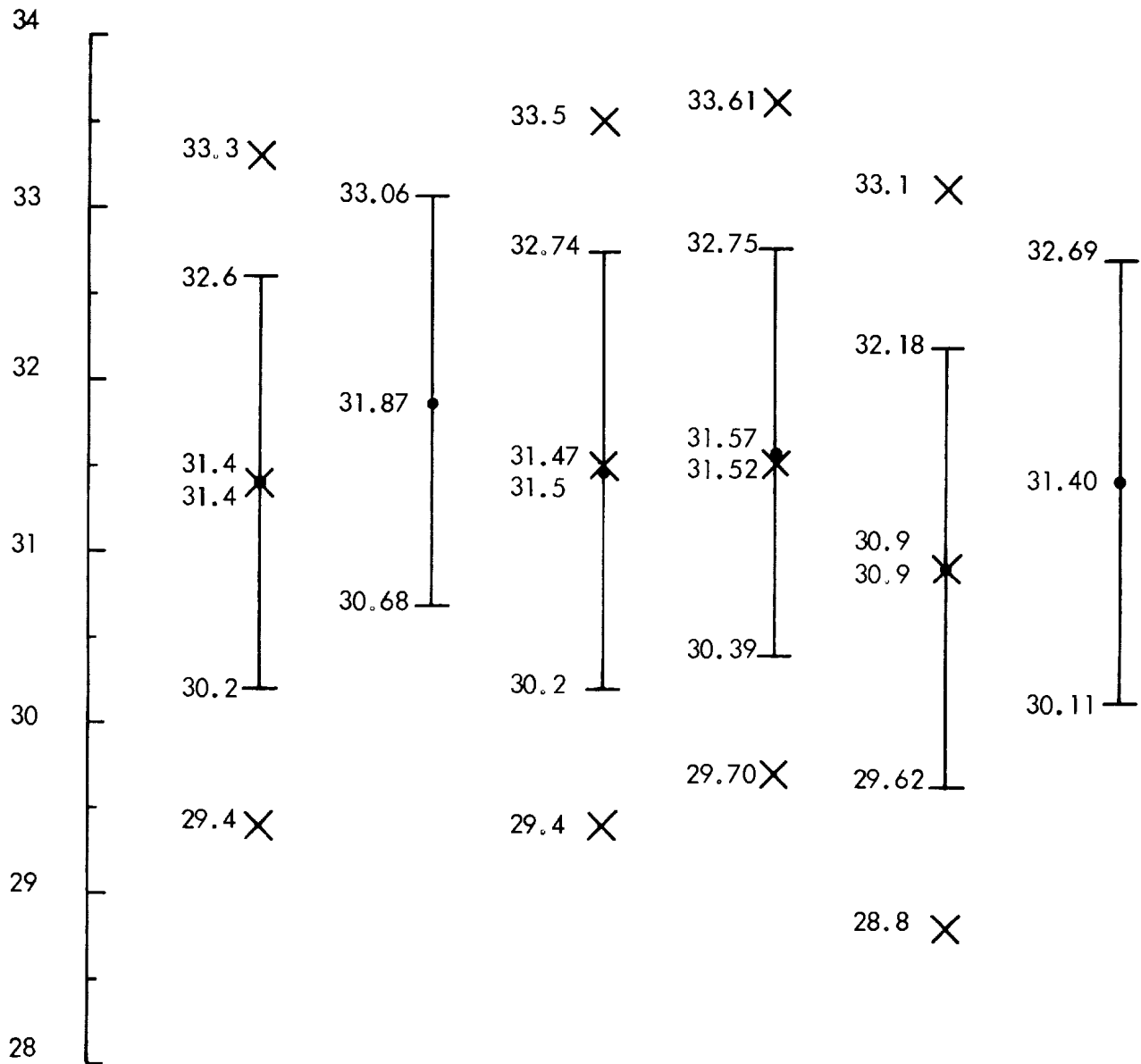


# SITTING HEIGHT

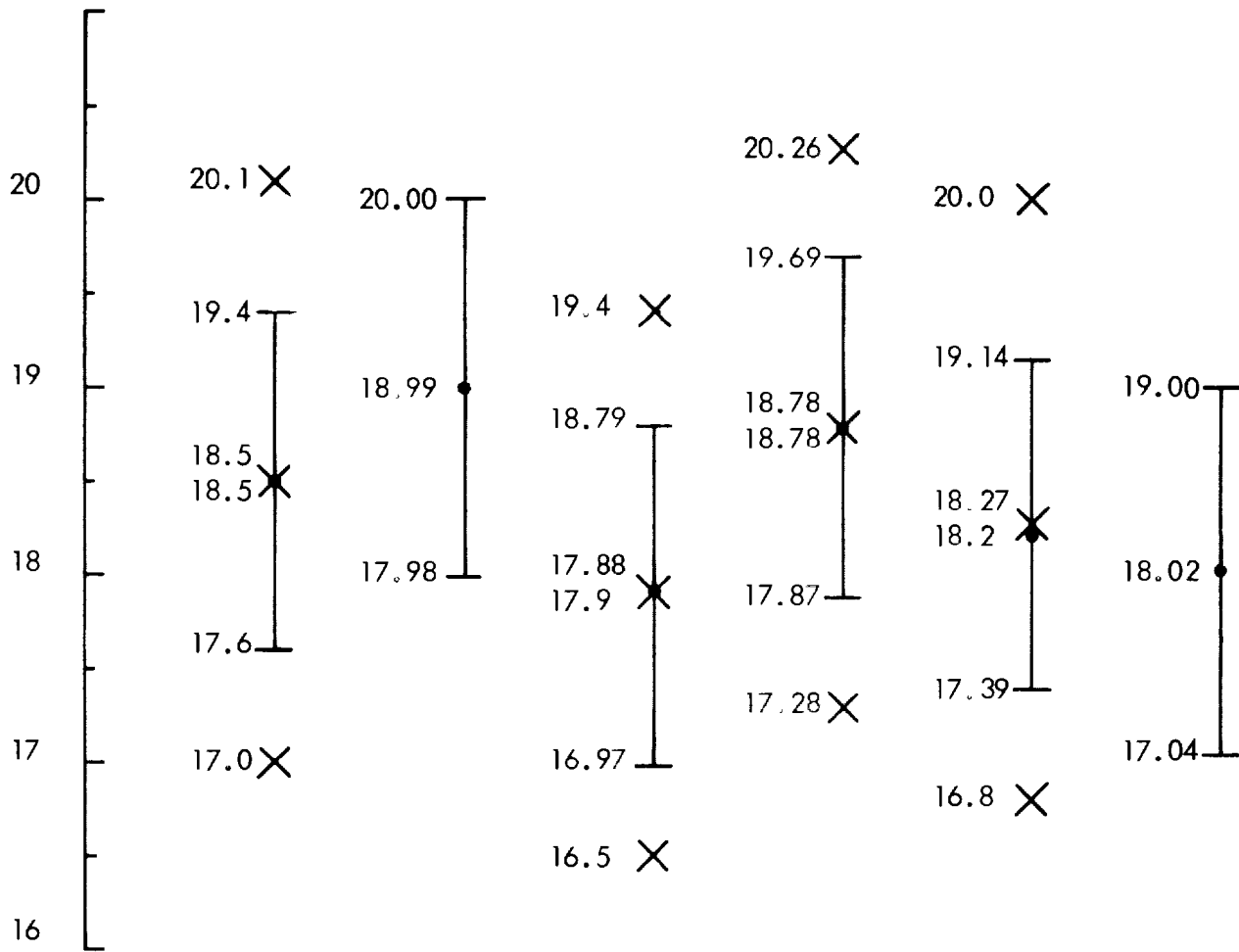




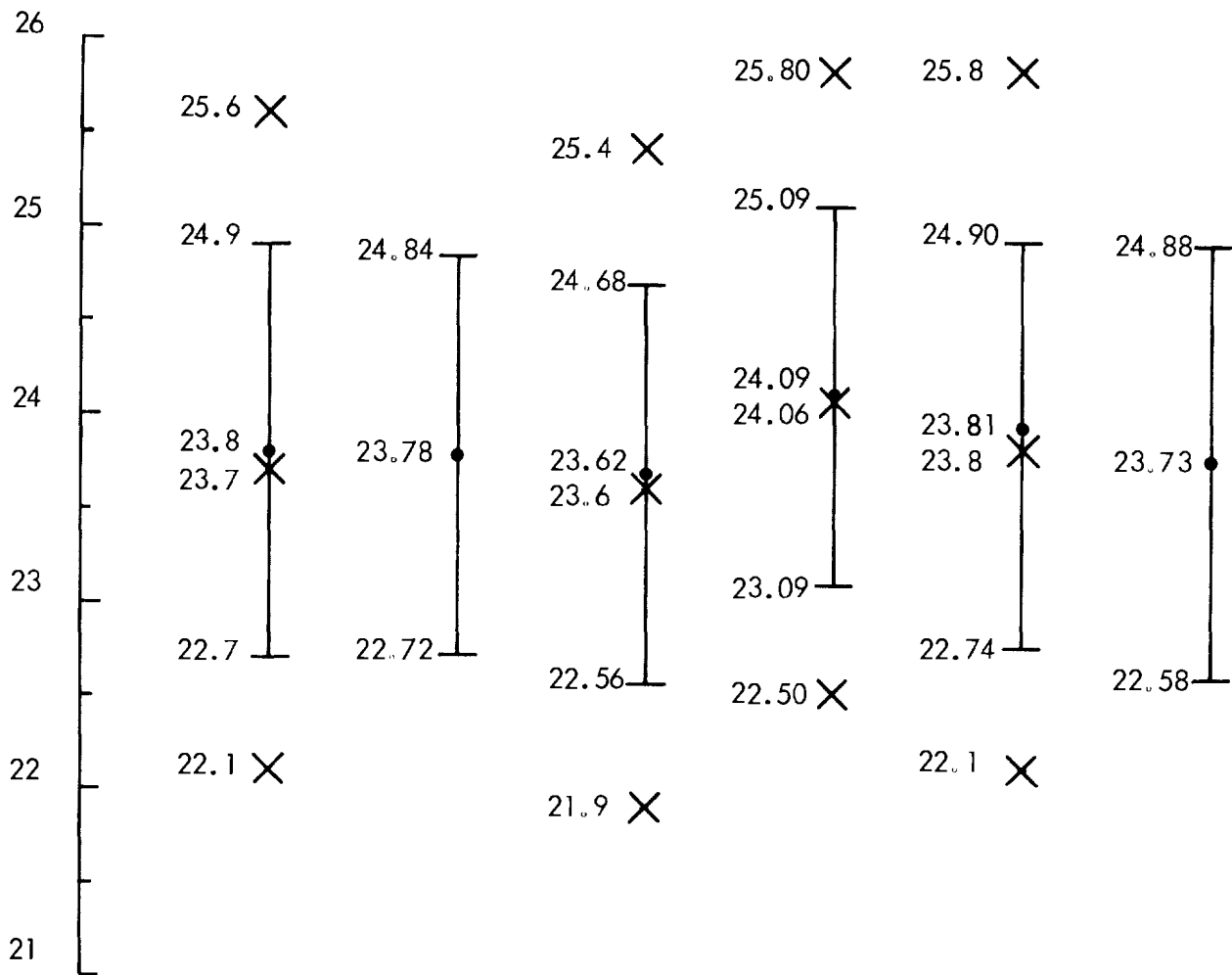
# SITTING EYE HEIGHT



# BI-DELTOID DIAMETER



# BUTTOCK-KNEE LENGTH



# SITTING HIP BREADTH

